DOCUMENT RESUME

ED 096 417 CE 002 016

AUTHOR	Loebl, Stanley, Ed.; And Others
TITLE	Correlated Curriculum Program: An Experimental Program. Science Level 1 (9A, 9B, 10A).
INSTITUTION	New York City Board of Education, Brooklyn, N.Y. Bureau of Curriculum Development.
PUB DATE	Mar 70
NOTE	79p.
EDRS PRICE	MF-$0.75 HC-$4.20 PLUS POSTAGE
DESCRIPTORS	Behavioral Objectives; Business Education; Career Education; Curriculum Design; Curriculum Guides; Health Education; Industrial Education; *Integrated Curriculum; *Science Units; *Secondary Grades; Student Evaluation; *Teaching Guides; Unit Plan; *Units of Study (Subject Fields)

ABSTRACT

The unit plans in Correlated Science 1 are intended to be of use to the teacher in both lesson and team planning. The course in science was designed for optimum correlation with the work done in business, health, and industrial careers. Behavioral objectives, class routines, time allotments, student evaluation, and the design of the manual are briefly discussed. The science topics taught are: controlling the indoor environment; light, the silent salesman; power for office machines; power for transportation; science at work in the auto service station; science in cleaning and laundering; and science and restaurant operations. Each unit contains time allotments, lesson aims, materials and equipment needed, motivations, concepts and understandings to be developed accompanied by suggested procedures and activities, a summary, and resource materials. Two units not correlated with the work of business careers (a unit on evolution and earth science) are listed. (BP)

#203-100-DAS
3/25/70-eh

ED 096417

CURRICULUM PROJECT REPORT

Limited Distribution

BEST COPY AVAILABLE

CORRELATED CURRICULUM PROGRAM

An Experimental Program

Science Level I (9A, 9B, 10A)

(Correlated with Business Careers)

Revised

U S DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRO
DUCED EXACTLY AS RECEIVED FROM
THE PERSON OR ORGANIZATION ORIGIN
ATING IT. POINTS OF VIEW OR OPINIONS
STATED DO NOT NECESSARILY REPRE
SENT OFFICIAL NATIONAL INSTITUTE OF
EDUCATION POSITION OR POLICY

Project No. 10006

These experimental curriculum materials were prepared as part of the Curriculum Workshop Program of the Bureau of Curriculum Development in cooperation with Correlated Curriculum and Pre-Technical Programs.

March 1970

DE002016

BUREAU OF CURRICULUM DEVELOPMENT
BOARD OF EDUCATION • CITY OF NEW YORK
131 Livingston St., Brooklyn, New York 11201

16M-3/70 82

BOARD OF EDUCATION OF THE CITY OF NEW YORK
CORRELATED CURRICULUM PROGRAM

TEACHERS' MANUAL - SCIENCE CORRELATED WITH BUSINESS CAREERS - LEVEL I

Contents

	Page
Acknowledgments	a
Introduction	b
Objectives	b
Teaching the General Student	c
Class Routines	c
Time Allotments	c
Evaluation and Grading	c
Design of the Manual	d
Unit 1 - Laboratory Safety	1
SCIENCE TOPICS FOR WORKING IN A STORE	
Controlling the Indoor Environment	4
Unit 2 - Heat and Temperature	4
3 - Transfer of Heat	7
4 - Heating and Air Conditioning	10
5 - Refrigerating and Freezing Food	13
6 - Wearing Apparel and Heat	16
Light, the Silent Salesman	18
Unit 7 - How Light is Produced	18
8 - Transmission of Light	20
9 - Color	22
10 - How We See	24
11 - Good Lighting	26
SCIENCE TOPICS FOR WORKING IN AN OFFICE	
Power for Office Machines	28
Unit 12 - The Flow of Electricity (Electric Currents)	28
13 - Electromagnets and Relays	31
14 - Electrical Generators and Motors	33
15 - Machines That Help Us to Communicate	36
SCIENCE TOPICS FOR WORKING FOR A TRANSPORTING COMPANY	
Power for Transportation	40
Unit 16 - The Internal Combustion Engine	40
17 - The Steam Engine	43
18 - Flight	45

Table of Contents (continued)

	Page
SCIENCE TOPICS FOR WORKING IN A SERVICE INDUSTRY	
Science at Work in the Auto Service Station	49
Unit 19 - Petroleum and Liquid Fuels	49
20 - Safety in the Service Station	52
21 - Friction and Lubrication	55
22 - Useful Friction (Brakes)	59
23 - Tires	62
24 - Batteries	64
Science in Cleaning and Laundering	67
Unit 25 - Solvents and Detergents	67
Science and Restaurant Operations	70
Unit 26 - Pest Control	70
NON-CORRELATED UNITS	72

ACKNOWLEDGMENTS

These materials were prepared as part of the Curriculum Development Workshop Program of the Bureau of Curriculum Development, Dr. David A. Abramson, Acting Director, in cooperation with the Correlated Curriculum Program, Gordon Lebowitz, Director. Dr. Harry E. Wolfson, Assistant Superintendent, provided guidance and assistance to the project. Dr. Seelig Lester, Deputy Superintendent of Instructional Services, provided overall supervision of the program.

The original manuscript and revisions were prepared by the following writers under the direction and coordination of Gordon Lebowitz, Director, Correlated Curriculum Program.

Stanley Loebl, Chairman, Biological Science,
Springfield Gardens High School

Morton P. Lucash, Chairman, Physical Science,
Springfield Gardens High School

Staff Consultant:
Leo Schneider, Writer-Coordinator,
Correlated Curriculum Program

Dr. Daniel A. Salmon, Acting Assistant Director, Bureau of Curriculum Development, directs and coordinates the Curriculum Development Workshop Programs.

TEACHERS' MANUAL, SCIENCE CORRELATED WITH BUSINESS CAREERS
LEVEL I-(9A-9B-10A) (Revised)

Introduction

The unit plans in Correlated Science I are intended to be of use to the teacher in both lesson and team planning. The plans are an expansion of the Correlated Course Outline (Document 1). Units vary in length. The units may be modified, both in content and duration, to meet the needs and interests of the class. These plans should be regarded as guides, not as prescribed courses of study.

The 26 units in this group are closely correlated with the learnings in the Business Careers class. A second group of units, not correlated, is provided on page 72.

The course in science was designed for optimum correlation with the work done in Business Careers, Health Careers, and Industrial Careers, Level I. However, the pupil who has finished Level II as well as Level I in Science, will be provided with substantially all of the subject matter of the customary sequence of General Science and General Biology.

Objectives

1. To provide the student with a measure of scientific literacy in a science-oriented society.

2. To encourage critical thinking and the questioning attitude.

3. To provide scientific background correlated with Business Careers.

4. To provide basic manipulative skills in science.

Behavorial Evidences of Attainment of Objectives

- The student is able to use laboratory equipment safely and skillfully.
- The student has a grasp of the underlying principles of machines he will use in the science laboratory or the Business Careers laboratory.
- The student is able to make basic measurements using the metric system.
- The student can pass a performance test involving laboratory skills.
- The student can write simple, concise laboratory reports based upon his experiences. He can also make such reports orally.
- The student can profitably read background text material related to science.
- The student has developed a respect for laboratory equipment, and takes care not to damage it.
- The student can pass objective tests in subject matter.
- The student functions well as a member of the team in class and laboratory.
- The student renders class and school service.
- The student shows interest in current scientific developments.
- The student shows evidence of critical thinking.
- The student can relate his science background to processes and equipment used in business careers.

Teaching the General Student

This course of study has been planned for use in the program for the teaching of general students. Since the general student finds it difficult to think in abstract terms the emphasis is upon concrete achievements through manipulative skills. Additional motivation is provided through emphasis upon career applications. Audio-visual aids, laboratory experiences and manipulative skills form the main basis for the lesson development. Motor activity plays an important role in intellectual development. It should be stressed.

Class Routines

Routines are important in the world of work. Employers seek to develop routines so that work output may become more efficient. In order to prepare pupils to take their place in our economic society, it is important that they establish efficient work routines early.

It is expected that each pupil will keep a laboratory notebook in which the experiments performed and the results obtained will be clearly written. For example, the teacher may reproduce and distribute direction worksheets. These should be copied in the notebook and the results of the experiments added. The solutions to problems which have been posed as basic for solution through experimentation should be clearly written out and checked periodically by the teacher. The notebook should contain such suggested items as materials which were used, diagrams of apparatus and results obtained.

A second section of the notebook might be devoted to summarization of lessons, observation charts, homework assignments and the like. Reports and reporting techniques should be established early through cooperative efforts with the English teacher.

The class may be divided into committees for efficient methods of distribution of laboratory materials, for cleanup, and for other classroom routines. It is important for the development of good work habits that pupils be held responsible for the efficient completion of assigned tasks and duties.

Time Allotments

The time allotment should be flexible. It is impossible to determine in advance the speed of progress of each class. The teacher should feel free to revise the time schedule as the occasion warrants. There is always the possibility that certain material may need extended demonstrations of techniques, added explanation, or follow-up lessons by the teacher. It is important for the teacher to realize that he is not expected to cover everything. The teacher should plan to use as much time as is needed for successful accomplishment. The emphases should be upon pupil accomplishment rather than ground covered.

Evaluation

Marks and Grading

The mark that a pupil achieves will be an important determinant in the mind of the pupil measuring his potential success in the field. If he passes, he will be stimulated to continue with the course. If he fails, we have failed. Suc-

cess should be a built-in factor in the course. The final mark is based upon a complex of factors affecting his grade. The day-to-day performance in the classroom is an important consideration in assaying his final grade. His work habits must be considered. Test marks and grades should be taken into account, but should not be the final determinant. Notebooks and homework assignments must be inspected and checked. Extra rewards should be given for extra work, research or study. Credit may be given for voluntary work. Laboratory skills should be tested and graded.

There are other suggested possibilities for arriving at a final grade. It might be a good practice to try several open-notebook or textbook tests. Mastery tests may be given. Here, the pupil tells the teacher when he is ready for the test, and has mastered the subject. Such tests might even be given several times before the pupil passes. Or, the teacher might give lead-up tests before giving the final big test at the end of a unit, to ensure mastery of sub-divisions of the subject matter. Reports and class contributions should be rated, along with homework and special assignments. The entire complex of factors must be taken into account before assigning a final grade.

Suggested Criteria for Marking and Grading

--Given a specific problem, is the pupil able to plan and to set up laboratory equipment, use this equipment skillfully and arrive at valid conclusions for the solution of the problem?

--Is the pupil able to record neatly and accurately the results of his laboratory experiments?

--Is the pupil able to manipulate laboratory equipment skillfully, efficiently and safely without damage to himself, to others or to the equipment?

--Is pupil able to use standard reference books and texts to derive needed information?

--Is the pupil able to follow printed directions for laboratory experiments?

--Can the pupil work successfully as a member of the class team?

--Does the pupil have efficient work habits as evidenced by his notes, his records, his completion of assignments, research, reports and performance in the laboratory?

Design of the Manual

This manual is designed to assist the science teacher in the implementation of the curriculum of Science Correlated with Business Careers. Opportunities for correlation between science the the careers area have been developed in a series of unit plans. These plans offer demonstrations, pupil activities, films, and other references. They should provide considerable help to the teacher in both lesson and team planning.

Science Correlated with Business Careers Level I (9A, 9B, 10A)

Unit 1 - Laboratory Safety

These safety lessons are common to all three level I Correlated Science classes, and should be taught in the opening days of the term. It is recommended that a set of printed safety rules be distributed, or that the rules elicited in class be carefully set down in the pupils' notebooks as a summary.

Time: 2 lessons

Aims: . To learn the importance of working safely.
. To develop a set of useful laboratory safety rules.

Materials and Equipment

Test tubes
Racks
Slides
Cover slips
Lugol's solution
Microscope
Beaker 500 ml.
Sodium or potassium metal
Onion
Ammonia

Motivation

Display two beakers, one containing water, the other a "poisonous solution." State you have forgotten which is which. What would be the safest thing to do? Why? Develop need for special safety precautions in laboratory.

Development

Concepts and Understandings	Procedures and Activities
1. A laboratory is only as safe as the least safe person in it. It is the responsibility of each student to avoid accidents.	Demonstrate: Some unsafe kinds of behavior in the laboratory. . Shake water-filled unstoppered test tubes. . Pretend to hand-hold test tube in Bunsen flame. . Allow water to boil over in a test tube.
	Elicit: Dangers in these actions.
2. Following directions. . Read directions and follow them exactly. . When in doubt, ask the teacher. . Work quietly. . Give thought to the work. . Avoid rushing, but also avoid wasting time.	Demonstrate: Two students come up. Each is to prepare a slide of an onion cell. Materials are at hand. One student has a proper laboratory sheet, the other has none.
	Elicit: Advantages of having directions and following them.

Concepts and Understandings	Procedures and Activities
3. Poisons . Nothing should be eaten, drunk, or chewed in a laboratory. . Avoid any situation which may lead to any chemical being taken internally. Most chemicals are poisonous.	
4. Protective items . Protect clothing by wearing aprons. Many chemicals can eat holes in clothing. . Protect eyes with goggles when working with dangerous chemicals. . Spattering of liquids or flying particles from a shattering substance can cause serious eye injury, cuts and burns.	Demonstrate: Add sodium or potassium to water to create a small explosion. Caution: Determine beforehand the amount of sodium or potassium that will produce the desired effect. Start with a piece half the size of a pencil eraser. The solution remaining in the water is caustic.
5. Wash away with quantities of water any chemical spilled on the skin, clothing or desk. Many substances can burn or irritate the skin; others can cause fires.	Demonstrate: Proper method of quickly washing away spilled reagents.
6. When observing the odor of a substance, fan the gas toward your nose. Do not put your nose directly over the material.	Set up three test tubes half filled with liquids. Ask a student to identify the one containing ammonia, using proper technique.

Summary

Develop rules for safety in the laboratory to be recorded in notebooks.

Suggested Visual Aids

1. Films concerned with laboratory safety. Address:

   Indiana University
   Audio Visual Aids Department
   Bloomingdale, Indiana

   U.S. Public Health Service
   Division of Occupational Health
   Washington, D.C.

Visual Sciences
Suffern, New York

2. Posters on laboratory safety. Write to:

The Chemical Poster Company
619 Templin Road
Iowa City, Iowa

Business Topic: Working in a Store

Science Topic: Controlling the Indoor Environment

Unit 2 - Heat and Temperature

Time: 2 to 3 lessons

Aims: . (Introduction) To examine some ways in which we control our indoor surroundings to make them more comfortable and healthful.
. To learn the difference between heat and temperature.
. To study some devices that sense changes in temperature.

Development:

Concepts and Understandings	Procedures and Activities
1. We are able to control various factors in our indoor surroundings. .Temperature .Moisture .Air pollutants (dust, smoke, pollen)	Display: Pictures showing a store that is obviously air-conditioned, and an old-time store "cooled" by overhead fans. Demonstrate: Filtering dust from the air. See The General Science Handbook, Exer. 2638. (Bureau of Secondary Curriculum Development, N.Y. State Education Department, Albany, N.Y.) Elicit: .Factors that we can control in the air -Movement of air -Heating -Cooling -Moisture content -Filtration of dust, pollen, etc. NOTE: "Conditioning" refers to the control of all of the above factors; the term is sometimes used wrongly to indicate mere cooling of the air. .What is gained: -comfort -health -preservation of foods .Places that are conditioned: -homes, hotels -stores, restaurants -autos, buses, trains, planes, ships -theaters, auditoriums, etc. .How a store may gain by conditioning: -more customers enter -customers linger longer, buy more -relaxed, comfortable feeling of customer may lead to sales -employees' comfort and morale are improved

2. Control of temperature is achieved by control of the amount of heat introduced or withdrawn from a place. Heat and temperature are not the same thing.

Demonstrate: Two similar beakers stand on the same hot plate. Beaker "A" contains a quantity of water obviously less than the quantity in beaker "B". A thermometer is suspended in each beaker.

Elicit:
.Water in "A" boils first. Its temperature at boiling is close to 100°C.
.When the water in "B" comes to a boil, its temperature, too, is close to 100°C.
.If A and B are put into contact, no heat will go from one to the other, because the water in both is at the same temperature. If they were at different temperatures, heat would go from the water of higher temperature to the water of lower temperature.
.The amount of heat in "B" is greater because there is more water there (greater volume). Because the greater volume could absorb more heat, it took longer to come to a boil.

3. We make use of various devices to sense temperatures.

Demonstrate: (review) Our senses are not accurate reporters. Pupil places his left hand in bowl of hot water, right hand in cold water. Then both hands are placed in a bowl of tepid water. Left hand reports sensation of cold, right hand a sensation of hot.

Elicit: Need for accurate methods of determining temperatures.

Demonstrate: Thermometers of various types - air, alcohol, mercury, indoor, outdoor, cooking, thermograph, bimetal strip, etc.

Elicit:
.They serve many purposes, but these thermometers all are based on the expansion and contraction of a metal or a liquid by heat and cold.
.Use of Centrigrade (Celsius) and Fahrenheit scales (briefly - these are taken up in the Health and Industry Science correlations.)

Demonstrate: Action of a thermostat in controlling heating plants, The General Science Handbook, Exer. 2634, 2635.

Pupil Activities:
.Report on special uses of thermometers in industry and in commercial food preparation.
.Report on thermostats, and how they control the temperature of a house or store.

.Teams of pupils measure and record temperatures in several classrooms at floor, rear door, windows, on a ladder several feet up. How can we account for the considerable differences in temperature in the same room? (To lead to the concept of transfer of heat taken up in the next unit.)

Business Topic: Working in a Store

Science Topic: Controlling the Indoor Environment

Unit 3 - Transfer of Heat

Time: 3 to 4 lessons

Aims:
- (Review of 7th year science) To study ways in which heat moves from one place to another (transfer of heat).
- (Review of 7th year science) To study the nature of heat conductors and insulators.
- To learn how we use heat transfer, conductors, and insulators in controlling the indoor environment.

Development:

Concepts and Understandings	Procedures and Activities
To control indoor temperatures, we must know how heat moves, and how to control its movement.	
1. Heat moves by conduction (transmission within a substance by molecular collisions). There are great differences in the rates at which different substances conduct heat.	Demonstrate: Conductometer, with wax rings at end to show that different metals conduct heat at different rates. Elicit: As heat speeds up the motion of molecules, they collide with and speed up the motion of adjacent molecules, and so on, so that heat moves through the substance by conduction. Discuss: .Some substances, such as metals, conduct heat well (conductors), while others conduct very poorly (insulators). .Some uses of good conductors: metal cooking utensils, metal radiators. .Some uses of insulators: pot handles, rock wool and other building insulators, asbestos over hot water pipes. Demonstrate: Conductors and insulators. .Pupil holds glass and metal rods in flame. Which is the good conductor of heat? .Place an ice cube in the bottom of a Pyrex test tube. Hold it down with a metal nut or washer, and fill tube nearly full of water. Boil water by directing the Bunsen flame toward the upper part of the tube. Why doesn't the ice at the bottom melt? .Hold match at side of Bunsen burner, gas valve open. Why doesn't the burner light?

Concepts and Understandings	Procedures and Activities
	Elicit: .Glass, air, and water are poor conductors (therefore good insulators). .Some insulating uses of glass and air: -glass-lined hot water tanks -storm doors and windows make use of a layer of air as an insulator Display: Examples of insulators - asbestos, rock wool, glass wool, wood, insulated ice-cream bag Pupil Activities: .Pupils feel metal and wood parts of their desks. Both are at same temperature, yet metal feels colder. Why? .Make a list of substances commonly used for their insulating or conducting properties.
2. Heat moves by convection (a current in a liquid or gas, caused by uneven heating.)	Demonstrate: Heat may be transferred in a gas or liquid by a (convection) current. The warmer portion of the substance rises, while the cooler part falls. .Heat a beaker of water near one side. Some bits of sawdust in the water will circulate, showing the presence of the convection current. .Heat of a match held close over the hand is barely felt. Heat rising by convection can be felt many inches away when match is held under the hand. .Ventilation and convection currents of air. See The General Science Handbook, Exer. 1641. Elicit: .The warm part of the gas or liquid rises; the cooler part of it falls, setting up a circulation. .Best way to ventilate a room. .Why aren't radiators usually hung from the ceiling to save floor space?
3. Heat moves by radiation (rays or waves of energy, e.g., infrared rays that reach us from the sun.)	Demonstrate: Operation of radiometer. Elicit: .Energy for turning the radiometer comes from the sun, 93 million miles away. .There is no intervening substance in space to carry the sun's heat by conduction or convection. .A third method of heat transfer is radiation. .Rays or waves of heat and light can move through space.

Concepts and Understandings

Procedures and Activities

Demonstrate: Absorption and reflection of radiation. Use two similar empty food cans, one shiny, and one painted black. Fit each can with a thermometer. Place a lighted lamp halfway between the two, and note higher temperature readings in the can painted black.

Elicit:
.Experience of touching black fender and shiny chromium on a car on a hot day. Fender feels hotter. Why?
.Relation to silvered eye shields and white or silvered space suits of astronauts.
.Relation to spinning of radiometer, above.

Demonstrate: Sectioned thermos bottle.

Elicit: Thermos bottle is designed to avoid conduction, convection, radiation.

Films: (All available from BAVI)
.Heat - Its Nature and Transfer - (11 min.)
.Learning About Heat (8 min.)
.Nature of Heat (11 min.)

Business Topic: Working in a Store

Science Topic: Controlling the Indoor Environment

Unit 4 - Heating and Air Conditioning

Time: 3 to 4 lessons

Aims: To learn how homes, offices, and stores are heated and air-conditioned.

Development:

Concepts and Understandings	Procedures and Activities
1. Heating a building usually requires: .The burning of some type of fuel to produce heat. .A method of distributing the heat throughout the building. Common methods are: -hot air -hot water -steam -radiant heating (hot pipes or heating elements embedded in floor.)	Discuss: Types of fuel and their advantages and disadvantages: .coal .oil .gas Film: Our Common Fuels (11 min.) - Available from BAVI Demonstration and chalkboard diagrams (or charts - types of heating systems. .Hot air heating .Hot water heating - see The General Science Handbook, Exer. 2631 .Steam. See Handbook, Exer. 2632 .Radiant heating Discuss: Advantages and disadvantages of each type of heating system. Pupil Activities: .A class visit to the school heating plant, by arrangement with the custodian. What fuel? What heating system? What regulatory and safety devices? What information from meters and gauges? What attention needed to run system? What maintenance needed? What skills do workers need? .Assign pupils to compilation of a report based on research in visits to neighborhood homes, stores, offices, factory buildings, and garages. Same questions as class visit, above.
2. Air-conditioning a building (or a room) requires: .A means of cooling, filtering, and dehumidifying air. .A means of circulating conditioned air through the building (or the room).	Display: Diagram of a central air-conditioning system.

Concepts and Understandings	Procedures and Activities
	Elicit: .The air is cooled by a refrigerating system, and also filtered and dehumidified. .The conditioned air is driven by fans and circulated throughout the building in ducts.
3. The operation of both refrigerators and air conditioners is based on the principle that an evaporating liquid causes cooling.	Demonstrate: Cooling by the evaporation of a volatile liquid. See Physics Handbook, Exercise 2.28,a and b. (Bureau of Secondary Curriculum Development, N.Y. State Education Department.) Elicit: .Change of the volatile liquid to a gas removed heat from the thermometer. .Rapid evaporation of ethyl chloride removes heat from skin fast enough to freeze it. .Evaporation of alcohol is a common way to cool the skin of a feverish patient; he is given an alcohol rub. .Cooling effect of evaporation of water from a wet bathing suit. Display: .Chart or diagram of essential parts of refrigerator. .An old refrigeration unit, or parts of one, if available. Discuss: The refrigeration cycle. .A volatile liquid is pumped through pipes in the mechanism. It reaches an expansion point, where it evaporates suddenly; in evaporating, the liquid is cooled. .The cool gas passes along through coils within the refrigerator, removing heat from them, and thus from within the refrigerator. .A pump compresses the gas so it again becomes a liquid, and is heated in the process. .The heated liquid passes through another set of coils (usually found behind the refrigerator in the home kitchen type). .The heat is given off from the coils to the outside air. .The cool liquid is now ready to pass through the expansion point again, to evaporate and cool the coils inside the refrigerator. Elicit: Air conditioners operate like refrigerators through which air is blown to be cooled.

Concepts and Understandings	Procedures and Activities
4. Proper insulation of a building is an important factor in heating and air-conditioning it economically.	Pupil Activity: The importance of insulation. See The General Science Handbook, Exer. 2636. Display: Rock wool, sheet rock, glass wool, other insulating materials. Elicit: .Why is it good business to insulate stores and office buildings, even if the initial costs are high? .Revolving doors are expensive and they take up valuable space in stores. Why are they used? What other means are used to save on heat and air conditioning at entrances?

Business Topic: Working in a Store

Science Topic: Controlling the Indoor Environment

Unit 5 - Refrigerating and Freezing Food

Time: 2 to 3 lessons

Aims: . To learn how foods are preserved by the use of low temperatures.
. To learn some precautions needed in the commercial handling of foods preserved by low temperatures.

Development:

Concepts and Understandings	Procedures and Activities
1. Foods may be kept from spoiling by being held at low temperatures.	Display: Moldy bread or oranges, sour milk, or other spoiled foods. Elicit: .Evidences by which we recognize food that is spoiled. .Meaning of "spoiled" - not merely lack of freshness, but a chemical change in the food. .Reasons for avoiding spoiled food, both esthetic and physiological. .Spoilage comes about through the activities of organisms such as molds or bacteria. .Low temperatures kill or slow the growth of these organisms, and so prevent or slow the spoilage of food. .Refrigeration temperatures range below 50°F. to near freezing; freezing temperatures range beneath 32° F. to below 0°F.
2. Advantages of low temperature preservation of food. .convenience to consumer in less frequent shopping, easier preparation .availability of out-of-season foods .availability of perishables not otherwise available, e.g., pineapples or oranges in New York, lobsters in midwest.	Discuss: Advantages to the shopper in buying larger quantities that can be kept in home refrigerator or freezer. Pupil Activity: Class visit to a nearby supermarket, by prearrangement with the manager. Pupils list, with help of manager, foods that must be preserved with low temperatures. Which foods are out-of-season? Which foods come from a long distance?
3. Several types of low-temperature treatment are used in food preservation.	

Concepts and Understandings	Procedures and Activities
.Refrigeration	Elicit: On chalkboard, place list of foods that are normally kept by refrigeration (50°F. to above freezing).
.Quick-freezing	Display: Shattering power of ice formation. A bottle filled to the top with water, with screwtop firmly tightened, is placed in freezing compartment of refrigerator overnight. For safety in handling, the bottle should be in some type of container, e.g., a paperboard box. Elicit: .Water expands as it freezes. .Cells of some foods are torn apart as water in them freezes. Example: pulpy oranges on trees during a frost in Florida. .Slow freezing causes formation of large crystals of ice. These tear the cell walls of the food product. .Quick-freezing (at temperatures of -10°F. to -20°F.) causes formation of small ice crystals. These do not tear the cell walls. Once frozen, the food may be stored at temperatures of 0° to 10°F.
.Freeze-drying	Demonstrate: Evaporation under vacuum conditions. (NOTE TO THE TEACHER: It should be made clear that this demonstration is NOT freeze-drying. It shows only the evaporation of water under vacuum conditions.) Place copper sulfate crystals in a watch glass, and set on a vacuum plate under a bell jar. After a few minutes of evacuation of air, observe change of color in crystals from the normal blue of hydrated copper sulfate ($CuSo_4.5H_2O$) to the anhydrous state (white). As a control, place some crystals in a watch glass on the desk. Reference: "Consumer Reports," August, 1968 - information on freeze-dried coffee. Discuss: Freeze-drying a new process. .Food is frozen, then dehydrated under vacuum. .Far less bulky, containing very little water (used by astronauts). .Food may be stored at room temperature, reconstituted with water.

Concepts and Understandings	Procedures and Activities
4. Great care is needed in the handling of low temperature foods in stores.	Discuss: .Danger of refreezing thawed food .Need to provide against power failures .Need to store frozen foods quickly after unloading from freezer delivery trucks .Use of doors on vertical cases, but not on horizontal cases. (Review convection currents.) Relate to safe storage height limit in horizontal cases. Pupil Activity: You are the manager of a large frozen food section in a new supermarket. Write a set of rules to be followed by your assistants, who are all without experience in this work.

Business Topic: Working in a Store

Science Topic: Controlling the Indoor Environment

Unit 6 - Wearing Apparel and Heat

Time: 2 to 3 lessons

Aims: .To study the relation between clothing and body heat.
.To study the effect on body heat of the texture, color, and weight of clothing.

Development:

Concepts and Understandings	Procedures and Activities
1. Our bodies produce heat. When it is cold, we must insulate them to prevent loss of heat.	Elicit: Our bodies, at a temperature of 98.6°F., lose heat to the surrounding air, which is almost always cooler. .Like houses, we can be insulated against heat loss. (Clothing is the insulation.) .Air is a good insulator. .Birds fluff up their feathers in the cold, providing more dead air spaces among the feathers, for better insulation. .We use blankets that are fluffy because they have great numbers of dead air spaces, providing good insulation. Demonstrate: Examine cloth of wool and of cottom in microscope. Note and compare air spaces in each type. Elicit: We wear clothing with many dead air spaces in the fabric. The air spaces provide insulation against loss of body heat.
2. Our bodies need insulation in hot weather as well.	Demonstrate: Use potholders to pick up hot beakers or flasks. Elicit: .With the beakers, the problem is to prevent the body from gaining heat from the hot glass. .Potholders, like blankets or clothes, have many dead air spaces for insulation. .Display asbestos blanket. Suits made of non-flammable asbestos insulate fire fighters against heat gain from fire. .We must be insulated against heat gain from the sun in hot weather. .Clothing must be thin enough to allow evaporation of perspiration.

Concepts and Understandings	Procedures and Activities
	.Wools are generally favored in winter for their high insulating property. .Cottons are preferred in summer, to provide some insulation, but also allow evaporation of perspiration.
3. The color of cloth may affect its usefulness as clothing.	Demonstrate: Use two identical empty food cans. Darken the surface of one can, leaving the other shiny. Fill both cans with ice cubes, place a thermometer in each can, and set the cans equidistant from a lamp. Demonstrate: Light and dark cloth squares, identical except for color, are exposed to the sun, or under a lamp. Allow pupil to feel both, sense temperature. Elicit: .Dark can absorbs more heat. Dark cloth absorbs more heat. .Relate to use of light-colored clothing in warm climates. .Relate to silvered visors, white or silvered clothing of astronauts. .Psychological factor also exists regarding use of light-colored clothing in warm weather. Pupil Activity: Write a paragraph discussing the types of cloth most popular with clothing customers at particular times of the year. Reference: .Filmstrip (free) Man-Made Fibers; .Booklet (free) Guide to Man-Made Fibers: Available from Man-Made Fibers Producers Association 350 Fifth Avenue New York, N.Y., 10001

Business Topic: Working in a Store

Science Topic: Light, the Silent Salesman

Unit 7 - How Light is Produced

Time: 1 to 2 lessons

Aims: . To Appreciate the role of lighting in displays and on the sales floor.
. To learn how light is produced.

Development:

Concepts and Understandings	Procedures and Activities
1. Light plays an important part in the successful operation of a store.	Assignment made previously: Pupils to observe window displays of selected stores in the vicinity of the school, as well as selected display cabinets in the school halls. Elicit: .Emotional reactions of pupils to displays that are well-designed and executed, vs. those where little effort is made to attract and hold the observer. .Relate to the pleasant reaction on seeing attractively arranged food vs. food "thrown at you". .Some elements of display: -varied kinds of light -no deep shadows -use of color in pigments and lights Demonstrate: "Black" (ultra-violet) light, with fluorescing minerals or chalk. Relate to displays, theatrical use.
2. In order to see, we must have some kind of light.	Demonstrate: Arrange a class visit to school darkroom. If not possible, use a room where shades can produce virtual darkness. Observe hands, faces, books, then illuminate with electric lamp or flashlight. Elicit: .We can see objects only if light from them reaches our eyes. .Some objects (lamps, flashlights, the sun) give off their own light. They are sources of light. .Most objects (books, faces, the moon,) are seen only when light from a source is reflected by the object.

Concepts and Understandings	Procedures and Activities
3. a. Nearly all the light by which we see comes from some hot substance giving off light energy.	Demonstrate and list: Light of match, Bunsen burner, burning of magnesium ribbon (CAUTION: Warn pupils against looking directly at flame!), glow of a heated metal rod, light bulbs with visible filaments. Elicit: Although the heat was obtained in various ways, the light in all cases was the result of heating some substance. What substances are heated when we see -sunlight -a star -a spark -lightning -a bonfire
b. A small amount of light energy results from cool reactions or from radioactivity.	Display: Pictures of luminescent deep-sea organisms Elicit: Light of fireflies as examples of light without heat. Demonstrate: Production of light by chemical reaction. Prepare two solutions: Solution No. 1, is made by dissolving $\frac{1}{4}$ teaspoon of lye in a pint of water. Then dissolve a piece of luminol, $\frac{1}{4}$ inch in diameter in this solution. Solution No. 2, is made by dissolving $\frac{1}{2}$ teaspoon of potassium ferricyanide in $\frac{1}{2}$ pint of water. To this solution is added an equal amount of 3% hydrogen peroxide. In a dark room, both chemicals are added simultaneously to $\frac{1}{2}$ gallon of water in a transparent container. A clearly visible glow is seen. Demonstrate: Glow of an alarm clock with luminous dial. Geiger counter may be used to detect radioactivity. Pupil Activity: .Examine clear electric bulbs. Note electrical connections, tungsten wire filament. Why doesn't the filament burn up in the intense heat? .Compile a list of unusual light sources, e.g., meteors, comets, luminous fish, fireflies, luminous bacteria, etc. In each case, what is the cause of the light given off? Film: Learning About Light (8 min.) - available from BAVI

Business Topic: Working in a Store

Science Topic: Light, the Silent Salesman

Unit 8 - Transmission of Light

Time: 1 to 2 lessons

Aim: .To learn how light moves

Development:

Concepts and Understandings	Procedures and Activities
1. Light is a form of energy.	Demonstrate: Shine a light on a radiometer to cause it to spin. Elicit: .Energy is needed to make anything move. .Energy was required to make the radiometer spin. .Light is one form of energy. .(Review - Some other forms of energy sound, heat, etc.)
2. Light travels in transverse waves.	Demonstrate: Energy moves through water in transverse waves. See Science, Grade 9, p. 33, (Curriculum Bulletin No. 9, 1968-69 Series, Board of Education of the City of New York.) Elicit: .Energy moves away from point at center where it was applied by the falling piece of chalk. .The energy moves by the creation of a series of waves (transverse waves) that are visible. .The water is the medium through which the energy is spread.
3. Unlike sound, light needs no medium through which to travel.	Demonstrate: Bell in vacuum apparatus. When bell can no longer be heard, aim lighted flashlight through bell jar. Elicit: .Air in the bell jar is the medium through which the sound waves spread. .As the quantity of air in the bell jar is decreased, the sound grows fainter, until we no longer hear it. But we continue to see the clapper of the bell moving, and we can see light from the flashlight. .Sound waves must have a medium through which to travel. .Light does not need such a medium, e.g., light of the sun and stars reaches us through the vacuum of space.

Concepts and Understandings	Procedures and Activities
4. Light travels in straight lines.	Demonstrate, or Pupil Activity: Light travels in straight lines. .Pupils try to see light through a 15" piece of rubber tubing; this is possible only if the tubing is held straight. .See also Science, Grade 9, p. 32 Elicit: .Sound waves can spread around corners. .Light travels in straight lines only. .We cannot see people around a corner, or behind us, but we can hear them. .We can use mirrors to change the course of light. .Usefulness of mirrors in clothing stores, especially use of multiple reflections so customer may see many views of himself.
5. Light travels at enormously high speeds.	Elicit: .Lightning is seen before thunder is heard. .Light moves faster than sound. Discuss: .Speed of sound. See Science, Grade 9, pp. 15-16. .(Optional) Method used by Roemer to determine the speed of light. See Science, Grade 9, p. 32.

Business Topic: Working in a Store

Science Topic: Light, the Silent Salesman

Unit 9 - Color

Time: 1 to 2 lessons

Aims: . To learn how colors are produced.
. To learn how color may be used to advantage in sales displays.

Development:

Concepts and Understandings	Procedures and Activities
1. "White" light is made up of other colors.	Demonstrate: Formation of spectrum by a prism. See Science, Grade 9, p. 56. Elicit: .Colors come from the "breaking-apart" of the white light. .We see seven clearly identifiable colors, but there are a large number of gradations. All the colors we see make up the visible spectrum. .There are other colors, invisible to our eyes, present in the spectrum, e.g., infra-red and ultraviolet. .If the colors of the spectrum can be reassembled, we should get back "white" light. Demonstrate: Use of magnifying lens or inverted prism in color box to recombine spectrum into a white beam. Discuss: Other visible spectra seen: rainbows, diamonds, oil films on water, etc.
2. The color of an object is the color it reflects or transmits.	Display: Opaque and transparent objects of various colors. Include filters. Discuss: .In ordinary (white) light an opaque object may absorb most colors and reflect one. We see the reflected color, (e.g., an object that reflects only red light appears red to us.) .With transparent objects a certain color may get through (be transmitted), while other colors are absorbed. The transmitted color is the color we see.
3. (Optional) primary colors (both in lights and in pigments) can be mixed to produce other colors.	Demonstrate: Color mixing. See Physics Handbook, p. 150, Exercise 3.65 (Bureau of Secondary Curriculum Development, State Education Department, Albany, N.Y.)

Concepts and Understandings	Procedures and Activities
	Elicit: .Certain colors of light, called the primary colors, may be mixed to produce other colors. .In pigments, a different set of colors are the primaries. Like the primaries of light, they may be used to produce new colors. Pupil Activity: Color mixing. Pupils use magnifying lenses to examine colored pictures from magazines. Which colored dots represent the primary colors? Which primaries are used to produce the impression of green? Orange?
4. Colors, display, and selling.	Demonstrate: How not to light a display. A mercury vapor or sodium vapor lamp gives a ghastly tone to skin. Elicit: .Why don't stores use mercury or sodium lamps for display or on the selling floor? .What kinds of lights are used so customers will see merchandise and themselves in the most flattering way? .How are colors used to make merchandise stand out invitingly against the background? .What color of lights display meat products most temptingly? .Why do customers sometimes like to look at merchandise in sunlight instead of inside the store? .What colors of light create moods of relaxation and coolness? .What colors are associated with a feeling of excitement and tropical climate? Film: Color (6 min.); available from BAVI

Business Topic: Working in a Store

Science Topic: Light, the Silent Salesman

Unit 10 - How We See

Time: 2 to 3 lessons

NOTE TO THE TEACHER: The structure and function of the eye are a part of the Science correlation with Health Careers, Level I. Structure and function should here be presented (or reviewed) briefly, and major emphasis given to the material on depth perception, persistence of vision, and optical illusions.

Aim: . To study some special features connected with the sense of sight.

Development:

Concepts and Understandings	Procedures and Activities
1. .Light entering the eye is focused by the lens onto the retina. .Nerve endings (rods and cones) in the retina sense the light. .The signals of the nerve endings are transmitted to the brain by the optic nerve.	Demonstrate: Chart and dissectible model of the eye. Elicit: (briefly) Functions of .cornea .lens .retina .optic nerve Pupil Activity: Finding the "blind spot" of the eye. See The General Science Handbook, Exer. 1540. Elicit: Blind spot is the point on the retina through which the optic nerve leaves the eye, therefore no sensing rods and cones are there. Pupil Activity: Making a jigsaw model of the eye; see The General Science Handbook, Exer. 1537.
2. Two eyes side by side give us a special advantage in seeing.	Pupil Activity: Look through a stereo-viewer with both eyes, then with one eye. Elicit: .What difference is observed? .Which picture is preferred? .Why? Pupil Activity: Advantage of having two eyes (stereoscopic vision). See The General Science Handbook, Exer. 1543.

Concepts and Understandings	Procedures and Activities
	Elicit: Value of stereo vision in .using tools .walking along the street .driving a car Demonstrate: Depth perception, using home-made depth perception box, or Health Education Department equipment.
3. We sometimes see things differently from the way they really are.	Demonstrate: .Large cards with standard geometric illusions. .Looking into a mirror - is the image really behind the mirror? .Persistence of vision. See The General Science Handbook, Exer. 1545 - relate to moving pictures and television. Pupil Activity: Making flip booklets. See The General Science Handbook, Exer. 1546.
4. Displays are often designed to take advantage of our "mistakes" in seeing.	Display: Pictures to illustrate material of the discussion that follows: Discuss: .Creation of the illusion of depth in window and floor displays. .Inwardly curved store display windows that give an appearance of no window (no reflections of sidewalk or street). .Clothing patterns, e.g., small and large patterns, or stripes, that appear to make the wearer taller, shorter, thinner, stouter.

Business Topic: Working in a Store

Science Topic: Light, the Silent Salesman

Unit 11 - Good Lighting

Time: 2 to 3 lessons

Aim: . To study the characteristics of good lighting in stores and at home.

Development:

Concepts and Understandings	Procedures and Activities
The factors that go into "good lighting" vary with the aim to be achieved.	
1. Good lighting of displays.	Discuss: Some factors that make for good display lighting: .proper overall brightness .direction of attention where wanted, by use of special lighting, flashing or changing lighting, front, side, or rear lighting, and color. .proper use of textures and surfaces, to achieve desired reflection and absorption of light. .avoidance of deep shadows. Demonstrate: .Brightness at the light source. Use wax-foil photometer to observe relation between brightness and wattage of bulbs. See Lab. Manual, p. 175, Taffel, A., Physics: Its Methods and Meanings. Rockleigh, N.J.: Allyn & Bacon, or see Physics Handbook, Exer. 3.63. .Light on the object diminishes rapidly with distance from the light source. (optionally, may be taught accurately as varying inversely as the square of the distance). See Olivo & Wayne, Fundamentals of Applied Physics, p. 296. Albany, N.Y.: Delmar Publishers. If carried out in a darkened room, with care taken to avoid stray light, the light intensities at various distances may be measured with a light meter. .Effect of directional lighting. In a darkened room, test effect of lighting faces from front, then from side. Light familiar objects, e.g., Bunsen burner, platform balance, etc., from front, side, and rear. Invite speaker from Drama Club to talk on mood lighting.

Concepts and Understandings	Procedures and Activities
	Pupil Activity: Draw a plan for a window display of a particular item of merchandise or service (e.g., toys, an air conditioner, a trip to Hawaii, etc.) Tell what kinds of lights, direction of lighting, colors, and textures you will use. Why did you make the choices you did?
2. Good lighting at home.	Demonstrate: Set up a desk with a lamp to illustrate good and poor lighting for reading. .Direct light toward pupil's eyes instead of book. Then correct at direction of class. .Use an unshaded lamp to produce glare, then shade lamp properly. .Use a frosted and unfrosted bulb. .Use bright light on book, with no light in the rest of the room. Then correct by improving balance. .Place lamp so pupil's shadow falls on book. Then correct.
	Elicit: Some rules for good lighting at home.

Business Topic: Working in an Office

Science Topic: Power for Office Machines

Unit 12 - The Flow of Electricity (Electrical Currents)

Time: 6 to 8 lessons

Aims:
- To study the flow of electricity (currents).
- To learn which substances help or hinder the flow of electricity (conductors and insulators).
- To understand the reasons for the use of series or parallel circuits.
- To learn how various types of switches are used.
- To understand the need for fuses, and some safety practices associated with them.

Development:

Concepts and Understandings	Procedures and Activities
1. An electric current is a flow of electrons.	Demonstrate and Pupil Activity: A simple circuit. The General Science Handbook, Exer. 1214. .Open and close switch .Disconnect and reconnect dry cell
2. The path along which the electrons move must be continuous (a closed circuit).	Pupil Activity: In connection with above activity, allow time for practice in .cutting, stripping insulation, splicing, and taping bell wire. .setting up a simple series circuit with dry cell, switch, and flashlight lamp.
3. A break in any part of the circuit stops the current in all parts of the circuit.	Film: Electric Circuits; (12 min.) available from BAVI Loan Collection.
4. Electrons flow easily through some substances (conductors). They flow with difficulty, or not at all, through other substances (insulators).	Demonstrate: Conductivity tester. The General Science Handbook, Exer. 1222. Pupil Activity: Make a list showing, in order, the conductivity of the various materials tested. Elicit: .Which of these materials do we use because of their electrical properties? .What are some devices in which these materials are used?

Concepts and Understandings	Procedures and Activities
5. Circuits may be in series or in parallel .Meaning of each .Advantages and disadvantages of each .Uses of each in homes and offices.	Chalkboard: Show a bridge joining an island to the mainland, then a second, parallel bridge. What is the effect of blocking the only bridge? Of blocking one of the two parallel bridges? Demonstrate: Electrical analogy with parallel circuits. See Physics, Its Methods and Meanings, p. 398. Demonstrate and Pupil Activity: Series and parallel circuits. The General Science Handbook, Exer. 1210, 1211, 1212, and 1213, or Science, Grade 7, Long Form, pp. 88,90. (Curriculum Bulletin No. 14, 1966-67 Series, Board of Education, City of New York). Discuss: Problems of power failure in overuse; brownouts; power failure of 1965. Individual project: Electrical quizzer. The General Science Handbook, Exer. 1223. Film: Series and Parallel Circuits (13 min.); available from BAVI Loan Collection.
6. Switches of various types are used as a safe and convenient means of starting and stopping electric currents.	Demonstrate: .Knife switches .Wall switches (what advantage do they have over a knife switch?) .Bell pushbuttons (why better for the purpose than a wall switch?) .Flashlight switch (which of the above switches does it combine?) .Thermostat (bimetallic strip) .Mercury switch (what advantages over ordinary wall switch?) .Solenoids (why are they used?) .Three-way switches (what advantage do they offer?) The General Science Handbook, Exer. No. 1219, 1220. .Common types of switches used in office machines and appliances.
7. A fuse is a special kind of switch that operates automatically to protect a circuit from too much current.	Demonstrate: Need for fuses. Show heating effect of current, using heating coil. Touch a match to the coil. Demonstrate: How fuses work. The General Science Handbook, Exer. 1229, 1230, and 1231.

Concepts and Understandings

Procedures and Activities

Demonstrate: Fresh and burned-out fuses of various types, minibreakers, curcuit breakers.

Discuss:
- .short circuits from fraying wires, faulty connections, etc.
- .overloaded circuits by excess of electrical equipment on line
- .overloads from power source
- .need to ascertain cause of outage before reconnecting power.

Pupil Activity: On prepared rexograph sheets, draw diagrams to show connection of various types of electrical equipment. Use proper symbols. The General Science Handbook, Part 1, p. 61.

Bibliography:

Teachers

Taffel, Alexander. Physics, Its Methods and Meanings. Boston: Allyn & Bacon, 1969, Chap. 23, 24.

Beauchamp, Wilbur. Science is Explaining. Glenview, Illinois: Scott, Foresman & Co., pp. 250-270.

Pupils

Pamphlet: How Man Put Electricity to Work. Consolidated Edison Co., 4 Irving Place, New York, N.Y. 10003.

Pamphlet: Electricity and Wheels. General Motors, Detroit, Mich.

Business Topic: Working in an Office

Science Topic: Power for Office Machines

Unit 13 - Electromagnets and Relays

Time: 2 to 3 lessons

Aims: . To review the principles of electromagnetism.
. To learn the principles, operation, and uses of relays.

Development:

Concepts and Understandings	Procedures and Activities
1. (Review) A flow of electricity in a wire produces a magnetic field around the wire. The magnetic field disappears when the flow stops.	Demonstrate: .A magnetic field exists around a current-carrying wire. See Physics, Its Methods and Meanings, pp. 416-17, also Science, Grade 7, Long Form, p. 119. .Make and break circuit to show appearance and disappearance of magnetic field. Film: Electromagnets (10 min.) available from BAVI Loan Collection.
2. (Review) The strength of the magnetic field may be increased in various ways: .coiling the wire .increasing the current in the wire .inserting an iron core into the coil of wire.	Demonstrate: Attempt to pick up wire brads with uncoiled and coiled wire; by increasing the number of dry cells used in series; by inserting an iron core into the coil. See Science, Grade 7, Long Form, pp. 118-125.
3. Electromagnets have many uses.	Display: .Pictures of lifting electromagnets in auto junkyards, steel industry, etc. .Some devices based on electromagnetism, e.g., solenoid, galvanometer, electric motor, telephone, etc.
4. Relays and similar devices are special kinds of electromagnets, used for opened for opening or closing switches, activating circuits, carrying greater or lesser currents, or controlling the flow of liquids by actuating valves.	Demonstrate: .Use of relay to control a second circuit. See The General Science Handbook, Exer. 3231. .Circuit breaker. See The General Science Handbook, Exer. 3230. .Electric chimes. .Solenoid. See Physics Handbook, Exer. 4.42.

Concepts and Understandings	Procedures and Activities
	Display: .Solenoid from washing machine, used to actuate water valves .Automobile voltage regulator (relay) Discuss: Some other uses of relays: .In computers .Elevator pushbuttons .Photoelectric door openers .Automobile starting motors

Business Topic: Working in an Office

Science Topic: Power for Office Machines

Unit 14 - Electrical Generators and Motors

Time: 5 to 7 lessons

Aims: . To learn how electricity is generated mechanically.
. To learn some of the uses of electric motors in offices.
. To learn how electric motors operate.

Development:

Concepts and Understandings	Procedures and Activities
THE ELECTRICAL GENERATOR	
1. (Review) A wire that is carrying an electric current is surrounded by a magnetic field.	(Review) Recall demonstration in Unit 13. Film: Electricity: How It Is Generated; (11 min.) Available from BAVI Loan Collection.
2. An electric current is induced in a wire (or other conductor) that is moved in a magnetic field.	Demonstrate: Induced current. See The General Science Handbook, Exer. 3214; or Olivo & Wayne. Fundamentals of Applied Physics, p. 219. Albany, N.Y.: Delmar Publishers. (A center-needle galvanometer must be used.)
3. The strength of the induced current may be increased in several ways: .By increasing the speed with which the conductor and/or the magnetic field is moved. .By winding the conductor into a coil. .By increasing the strength of the magnetic field.	Demonstrate or Pupil Activity: Observation of of increase in galvanometer readings (same set-up as in demonstration above) as .The wire or magnet is moved more quickly. .More turns are made in the coil. .A stronger magnet is used.
4. The direction in which the induced current flows depends on the direction of the relative motion of conductor and magnetic field.	Demonstrate or Pupil Activity: Observation of change in direction of induced current as motion of magnet or coil is reversed. Elicit: .A current flowing in one direction is a direct current (DC). .A current with a back-and-forth motion is an alternating current (AC).

Concepts and Understandings	Procedures and Activities
5. A magneto is designed in a way that allows a coil of many turns to move at high speed in a strong magnetic field. .The main parts of the magneto are: a.field magnets b.armature (coil of wire) c.slip rings d.brushes	Demonstrate: Operation of hand-cranked magneto, feeding a neon lamp. With slow turning, the plates of the lamp glow alternately, indicating an alternating current. Elicit: .The reason for the alternate glow is the alternating current, or AC. .A current which flows in one direction only is direct current or DC. Demonstrate: Dismantle an automobile generator, or a bike-light generator, and identify the main parts.
6. Generators can be designed to produce either AC (by use of slip rings) or DC (by use of a split-ring commutator).	Demonstrate: .AC-DC demonstration generator joined to oscilloscope to show wave pattern in AC, DC .Flow of current via a. slip rings b. commutator Chalkboard: Diagrams to explain flow of current via slip rings, and via commutator. Elicit: A commutator is an automatic built-in reversing switch. Pupil Activities: .Construct a home-made generator. See Buban and Schmitt, Understanding Electricity and Electronics, pp. 227, diagram 37-14, (McGraw-Hill, New York, N.Y.) .Demonstrate the operation of a hand-generator flashlight .Report on advantages of AC, DC .The advantages and disadvantages of various methods used for generating electricity: steam, hydro, nuclear.

THE ELECTRIC MOTOR

7. Nearly all machines in the modern office are powered by electric motors.	Visit: Business Practice Department Office and classrooms, general office of the school. Pupils make lists of machines used, function, and way in which they are powered. Display and discuss: Pictures of offices, computer centers. Elicit variety of uses for electric motors, make lists of uses.

Concepts and Understandings	Procedures and Activities
8. (Review): .A coil carrying a current acts as a magnet. .The magnetic poles of a coil may be reversed by reversing the current.	Demonstrate: .An electrified coil acts as a magnet. Bring coil of copper wire near compass. Observe effect when coil is connected to dry cells. Repeat with suspended bar magnet in place of compass. .Reversal of poles, by reversal of coil connections to dry cells.
9. Like magnetic poles repel, while unlike poles attract.	Demonstrate: Attraction and repulsion of magnetic poles, using suspended bar magnets. Repeat with two suspended coils. See The General Science Handbook, Exer. 2212.
10. An electric motor is based on the alternate attraction and repulsion of magnetic poles. .In the DC motor an armature (coil) turns, as a commutator causes it to reverse polarity in the field of a permanent magnet or an electromagnet. .In the AC motor the refersal of polarity is caused by the alternations of the current, so there is no need for a commutator.	Discuss: (review) - Action of the commutator - (chalkboard diagram) Pupil Activity: Distribute St. Louis motors; pupils identify magnets, armature, commutator, and run motors on low DC voltage. Demonstrate: Conversion of DC motor to AC, using dual type demonstration motor. Pupil Activity: Construct a simple motor. See Buban and Schmitt, Understanding Electricity and Electrons, pp. 282, 390; or The General Science Handbook, Exer. 3236.

Business Topic: Working in an Office

Science Topic: Power for Office Machines

Unit 15 - Machines that Help us to Communicate

Time: 10 to 12 lessons

Aims: . To examine the ways in which electrical and electronic communicating devices are used in offices.
. To learn how these devices work, and the principles on which they are based.

Development:

Concepts and Understandings	Procedures and Activities
1. Modern offices depend on a variety of electrical and electronic devices for fast communication.	Discuss: Some devices for communication, displaying devices or pictures of them: .telegraph .teletype .telephone (including data transmission) .radiotelephone (autos, boats) .intercom systems .public address systems .tape recorders and other dictating machines .radio
2. The telegraph (little used today) Principles: .based on electromagnetism .long distances require large current, but relay circuits eliminate this problem. Advantages: .simple equipment .economical .fast (compared to trains or Pony Express Disadvantages: .Sender and receiver must be joined by wires - a break stops the apparatus. .Operators need special training in code. .Transmission is slow.	(Review): .principles of electromagnetism .principles and uses of relays Demonstrate: .Working model of telegraph key and sender. Identify switch, electromagnet, cells, wires. .Morse code, as class watches chart of code. Send some words in code for deciphering by the class. Elicit: .Need for relays over long distances. .Operation of relays. Pupil Activity: .Building a simple two-way telegraph system. See The General Science Handbook, Exer. 2252. .Building a relay. See The General Science Handbook, Exer. 3231.

Concepts and Understandings	Procedures and Activities
3. The teletype Advantages over telegraph .No training in code .Very fast .Provides written record	Discuss uses of teletype: .Public communication (e.g., Western Union) .Linking of branches of a firm .News, financial, sports, etc., reporting .Airline, hotel reservations (Telex) Pupil Activity: Report on ways which business firms make use of teletype equipment.
4. The telephone - permits instant vocal communication over long or short distances. It is also used in transmission of photographs and diagrams, and of data for computers. Principles: .Sound (vibrations of air) is changed to an electric current, then back to sound. .The strength of the current is made to vary by changes in the resistance of the circuit (initiated in the mouthpiece) .The varying current causes vibrations in a diaphragm (receiver). These vibrations in turn cause air vibrations or sound.	Discuss: Uses of telephones in offices. Visit: Arrange class trip to local telephone exchange. Visual Aids: The telephone company provides films and other aids. Demonstrate: .A telephone circuit, with visible evidence of the current. See The General Science Handbook, Exer. 3245. .Principle of the telephone transmitter (mouthpiece). See The General Science Handbook, Exer. 3246. Review factors influencing the strength of an electromagnet. .Principles of the telephone receiver. Pupils are allowed to feel the vibration of the diaphragm in the old type of receiver. Review production of sound by vibrating bodies. .Demonstration of the operation of a switchboard.
5. Intercom systems .Intercoms work on the same principle as the telephone. .They are usually limited to a small number of stations. .The transmitter and receiver are combined in a single unit. .An amplifier is used to increase the volume of the sound.	Discuss: Places and situations in offices in offices in which intercoms are useful in preference to telephone. Demonstrate: .Intercom system. .Sound-powered telephone made by hooking up two telephone receivers. Compare to intercom, which has an amplification device added.
6. Public address systems .Essentially one-way intercoms .Great amplification available	Demonstrate: Public address system, or a bullhorn. Elicit: .Office situations in which P.A. systems are valuable. .Need to avoid disruptions by excessive use. .Need to speak from a written or mental "script" to avoid creating confusion.

Concepts and Understandings	Procedures and Activities
7. Tape recorders. These and similar devices are an important means of giving dictation for later transcription. Principles: .In making the tape recording, sound energy is changed into electrical energy of a fluctuating pattern. .The fluctuating electrical energy is recorded as varying intensities of magnetism on a magnetic tape. .In playing back the tape, the varying intensities of magnetism are changed into electric currents of varying strength. These currents are then changed to sound. .Established magnetic patterns may be erased by passing the tape through a fluctuating magnetic field.	Elicit: .Types of tape recorders, uses for entertainment and business. .Some situations in an office in which use of tape recorders is important. Review: Demonstration in lesson on telephone, in which sound was changed to an electric current. Demonstrate: .Use of oscilloscope to show changing of sound to electrical current. .Prepare a series circuit with a telephone transmitter, dry cells, and lamp. Note fluctuations in brightness of lamp when talking into transmitter. Demonstrate: Making a magnetic impression. Use a magnet model of the type used to illustrate the molecular nature of magnetism (many small rotatable bar magnets). Pass a magnet over the model, causing new arrangements of the small magnets. Compare to magnetic rearrangement in tape. Compare tape to piano player roll. Demonstration: Magnets of different strengths produce currents of different strengths. See The General Science Handbook, Exer. 3214. Recall: (from lesson on telephone) Fluctuating currents are used to produce sound. Demonstrate: Magnetize and demagnetize a steel rod, using a demagnetizer (degausser).
8. Radio and television are serving an increasing number of uses in business offices. .Radio telephone communication between offices and salesmen, executives, and truckers on the road. .Security uses of radio (walky-talky) and television in patrol and scrutiny of plant.	Discuss: Uses of radio and television in business.

Concepts and Understandings	Procedures and Activities
Principles: .A fluctuating electric current generates electromagnetic waves, which may be transmitted through space without the use of wires.	Demonstrate: .Transmission of waves from an induction coil to a receiver. See The General Science Handbook, Exer. 3248. .Electromagnetic induction. Relate to transmission of energy without the use of wires. See The Physics Handbook, Exer. 5.11.
.Electromagnetic radiation can induce an electric current in a conductor.	Demonstrate: Reception of electromagnetic energy by a receiving coil. See The General Science Handbook, Exer. 3249. Demonstrate or Pupil Activity: A simple radio receiver. See The General Science Handbook, Exer. 3250.
.Induced currents are changed to sound by the use of an amplifier and a speaker.	Display: A demonstration radio setup.
.Television is based on changing light to electricity and electricity back to light. The television camera changes varying light intensities to a fluctuating electric current.	Demonstrate: .Lightmeter (Photoelectric cell) .Crookes tube containing a fluorescent screen showing deflection of beam with magnet. .Oscilloscope See Physics Handbook, Exer. 5.43
.In television, as in radio, a fluctuating current is transmitted through space without the use of wires.	Demonstrate: Refer to or repeat demonstration in Section 8 of this unit.
.The television camera "scans" the object, converting variations in brightness to a fluctuating electrical current.	Demonstrate: Scanning. See The General Science Handbook, Exer. 3253, 3254.

Business Topic: Working for a Transporting Company

Science Topic: Power for Transportation

Unit 16 - The Internal Combustion Engine

Time: 5 to 6 lessons

Aims:
- To grasp the importance of the internal combustion engine in our everyday living.
- To study the principles underlying the internal combustion engine.
- To examine some special types of internal combustion engines.
- To appreciate the problems of air pollution caused by widespread use of internal combustion engines.

Development:

Concepts and Understandings	Procedures and Activities
1. The internal combustion engine plays an enormously important job in every aspect of our lives.	Elicit: .Meaning of "internal combustion engine" one in which burning (combustion) is carried out internally. .Ways in which our lives are influenced by the internal combustion engine: -automobiles, trucks, buses, motorcyclos -airplanes, both propeller-driven and jet -engines in boats and many ships -small pumps, lawn mowers, snow throwers, etc. .Modifications that would be required in our lives if there were no internal combustion engines.
2. To obtain controlled burning of the fuel, certain conditions must be present in the internal combustion engine: .The fuel must be finely divided (spray).	Demonstration: Air (oxygen) is needed for burning. The General Science Handbook, Exer. 1404.
.The proportions of fuel and air must be correct (explosive mixture).	Demonstration: Explosive mixture. The General Science Handbook, Exer. 3320.
.A fuel must be at a certain temperature (kindling temperature) before it will burn.	Demonstration: A comparison of the kindling temperature of several substances. The General Science Handbook, Exer. 1409.

Concepts and Understandings	Procedures and Activities
.The fuel must be burned within an enclosed space to harness the wanted power.	Demonstration: Project a cork from a toy calcium carbide cannon OR Boil water in a lightly stoppered test tube so stopper is shot out of test tube. Caution!
3. Internal combustion engines are designed to meet all the requirements of Section 2 (above).	Demonstration or Pupil Activity: Study a sectioned carburetor, or a chart of one. Elicit: .Formation of fuel spray .Mixing of fuel and air to form an explosive mixture Demonstrate: Model of a four-stroke cycle gasoline engine. Elicit: .Fuel is raised toward kindling temperature by compression. .Fuel burns in an enclosed space (cylinder). .Steps in the four-stroke cycle. Display: Some portable parts of an automobile engine: carburetor spark plugs piston valve Pupil Activity: .Demonstrate the operation of a model airplane gasoline engine. .Build a "breadboard" type of model (with moving parts) of a one-cylinder gasoline engine. .Visit an automotive shop (school or commercial). Pupil Reference: A Power Primer (General Motors Corp., Detroit, Mich.)
4. An automobile moves because the power of its engine is applied to turning its wheels.	Demonstrate: .The friction clutch. The General Science Handbook, Exer. 3335. .The fluid drive. General Science Handbook, Exer. 3336. .Variable gear ratios. General Science Handbook, Exer. 3340.

Concepts and Understandings	Procedures and Activities
5. A widely-used type of internal combustion engine is the Diesel engine.	Discuss: .Advantages and disadvantages of the Diesel engine. .Widespread use for trucks, ships, heavy machines. .Often used to generate electricity to provide the power for motion, e.g., in Diesel-electric combination locomotives or ships. Film: The Diesel Story; (19 min.) Available from BAVI Loan Collection.
6. Principles of Diesel engine operation. 1. No ignition system or spark plugs. 2. Higher compression ratio.	Demonstration: Show heat is produced when air is compressed in bicycle pump whose outlet is blocked. Discuss: High compression of air in Diesel engine heats air to a temperature at which fuel injected into cylinder ignites. Pupil References: Diesel, the Modern Power (General Motors Corp., Detroit, Mich.) - free. Teacher Reference: Crouse, William. Automotive Mechanics. New York: McGraw-Hill.
7. Internal combustion engines play a large part in the formation of air pollutants.	Discuss: .Problems of air pollution. See Science, Grade 8, pp. 82-88, Curriculum Bulletin No. 20, 1967-68 Series. (Bureau of Curriculum Development, Board of Education of the City of New York) (Two units on air pollution). See also A Primer on Air Pollution. (Mobil Oil Corp., 150 E. 42 St., New York, N.Y., 10017. .What can individuals and companies do to reduce pollution? -building superintendents -airlines -industrial concerns -operators of autos, buses, trucks

Business Topic: Working for a Transporting Company

Science Topic: Power for Transportation

Unit 17 - The Steam Engine

Time: 1 lesson

Aims: . To study the principles on which the steam engine is based.
. To appreciate the historic importance of the steam engine, and the reason for its present decline.

Development:

Concepts and Understandings	Procedures and Activities
1. The steam engine is an external combustion engine.	Demonstrate: Operate a working model of a Display: Pictures of ancient automobiles, both steam and gasoline-powered; elicit differences in means of power. Elicit: .Meaning of external combustion; compare with internal combustion. .Industrial Revolution based largely on availability of massive power from steam engine. .Decreasing use of steam locomotives and other steam engines today - refer to locomotives seen in old moving pictures. .Continuing use of steam engines for generating electricity.
2. Principles: .Any fuel may be used.	Elicit: .Variety of fuels that may be used, depending on availability, convenience and cost. .Increasing use of nuclear energy to supply the heat for making the steam for generating electricity.
.The heat from the burning fuel is used for boiling water in pipes within a closed tank (boiler); the water changes to steam.	Demonstrate: Boil water in pot to show lifting of lid by steam. Elicit: .Boiling water is changed to steam. .Pressure of the steam lifts the lid.
.As more steam is produced and remains confined, its pressure builds up.	Demonstration: Use pressure cooker or autoclave with pressure gauge to show increase of pressure within the vessel.

Concepts and Understandings	Procedures and Activities
.The pressure of confined steam can do work.	Demonstration: .A "one-shot" steam engine. Boil water in a loosely stoppered test tube. Stopper is projected from the test tube. Caution! .Working model of Hero's Engine, or a picture. See The General Science Handbook, Exer. 3333. .Rotation of the waterwheel by playing a stream of steam against it. Relate to turbines used for powering ships and generating electricity. .Cutaway model or chart of steam reciprocating engine, to analyze steps in its operation.
3. Steam engines are now outdated for many purposes they formerly served.	Discuss: .Inefficiency - large loss of heat energy in exhausted "waste" steam. .Large space requirements for boilers. .Need for constant replacement of water. .Time needed for building up working pressure of steam. Pupil Activities: .Display and discuss pictures or models of various kinds of steam locomotives. .Discuss reasons for better service by newer power sources in transportation (Diesel, Diesel-electric, all-electric).

Business Topic: Working for a Transporting Company

Science Topic: Power for Transportation

Unit 18 - Flight

Time: 5 to 7 lessons

Aims: . To examine the benefits and problems of large-scale civil aviation.
. To study the principles of flight.

Development:

Concepts and Understandings	Procedures and Activities
1. The airplane touches our lives in many ways.	Discuss: Benefits and problems connected with aviation. .Fast travel and communication .Cheap travel for long distances .Provides an opportunity for people from distant regions or countries to know each other. .Fast delivery of certain industrial products and perishable foods. .Casualties of war, especially among civilians, are greatly increased by aerial bombardment. .Noise and air pollution are increased. .Traffic problems near airports are created.
2. To fly, an aircraft must be a) held up by the air (lift) b) controllable c) propelled	Film: Airplanes and How They Fly; (11 min.) available from BAVI Loan Collection.
a) Lift.	Pupil Activity: Creating lift with sheets of paper. See The General Science Handbook, Exer. 2301, 2302A.
.Moving air can lift objects.	
.In activity above, lift resulted from a lessening of air pressure over the paper, while the pressure underneath it remained the same.	Pupil Activity: Lowering air pressure within an air stream. See The General Science Handbook, Exer. 2302B.
.In a stream of air, the air pressure drops as the velocity of the stream increases.	

Concepts and Understandings	Procedures and Activities
.The curved shape of an airplane wing (in cross-section) causes air passing over the wing to move faster than the air that passes under the wing. Air pressure on top is lessened, creating lift.	Display: Cross-sectioned wing of model plane or a chart. Demonstrate: Lift obtained from a curved wing-top. See The General Science Handbook, Exer. 2303. Elicit: .Particles of air move over and under the wing. .Particles that happen to move over the curved top of the wing must travel a longer path than particles that move along the underside of the wing. .Both groups of particles reach the back of the wing at the same time. .Therefore, the particles at the top must have moved faster than those underneath, creating a lower air pressure above the wing, and so, a lifting force. Demonstrate: The difference in air pressure on the upper and lower wing surfaces results in a lifting force. See The General Science Handbook, Exer. 2308.
b) Controls of an aircraft. An aircraft must be capable of -climbing and descending -banking (tilting) left and right -turning left and right	Pupil Activity: (Laboratory) .Functions of rudder and elevators. See The General Science Handbook, Exer. 2324. .Functions of ailerons. General Science Handbook, Exer. 2325. Demonstrate: .Large model plane, with clearly visible control surfaces. .(If available) Wind tunnel demonstration of model plane. Elicit: Functions of .stabilizers .vertical fin .elevators .rudder .ailerons Pupil Report: The automatic pilot Film: Problems of Flight; (10 min.) - available from BAVI Loan Collection.

Concepts and Understandings	Procedures and Activities
c) Propulsion	
.An aircraft must be pulled or pushed forward to move along the ground and through the air.	Demonstrate: Action and reaction. Pupil steps forward off a wheeled dolly (action), and dolly rolls backward (reaction).
.A turning propeller or jet engine pushes backward (action), producing a forward motion (reaction).	Demonstrate: Thrusting action of a propeller. See General Science Handbook, Exer. 2309. Elicit: On a plane, .Propeller pushes air backward (action). .Air pushes forward on propeller (reaction). .Propeller (and the attached plane) are thrust forward. Demonstrate: Principle of the jet. See General Science Handbook, Exer. 2314. Elicit: .A gas (carbon dioxide) is formed by the interaction of vinegar and soda. .The pressure of the gas forces the cork out of the bottle. .Movement of the cork (action) results in an opposite movement (reaction) of the bottle. Demonstrate: Inflate a toy balloon and release it. Elicit: .Air rushes from balloon (action), causing opposite motion of balloon (reaction). .In jet engines, burning fuel produces great volumes of gases, which are thrust backwards from the engine at enormous speed (action). Engine (and the plane it is attached to) are thrust forward (reaction). Film: Jet Propulsion; (14 min.) - available from BAVI Loan Collection.
.Rockets operate like jets, but they carry their own oxygen supply.	Display: Models and pictures of rocket engines. Elicit: .Basic difference between a jet engine and a rocket engine. .Need for rockets in outer space propulsion. Discuss: .Space probes to moon and planets .Manned flights to moon

Concepts and Understandings	Procedures and Activities
	Pupil Activities: .Build a model rocket or jet engine .Demonstrate a toy water powered "rocket" .Report on the pioneer rocket work of Robert Goddard Film: Rockets: Principles and Safety; (11 min.) - available from BAVI Loan Collection.
3. The helicopter - a special kind of aircraft.	Elicit: .Appearance of helicopter in flight -no wings -small vertical rotor at back (or two big counter-rotating rotors on top) .Special advantages of helicopters -ability to rise and descend vertically -ability to hover in one place -ability to fly sideways and backwards -usefulness in construction, police work, military uses, etc. Demonstrate: A home-made "helicopter rotor". General Science Handbook, Exer. 2319. Display: Model or large picture of helicopter. Elicit: .Engine turns big rotor(s). The wing-shaped cross-sectional structure of the blades is the reason lift is created. .Rotor can be tilted slightly forward, backward, or sideways, acting like a propeller to pull the craft in those directions. .Rotor blades can be pivoted to offer more or less lift, so craft can rise, descend, or hover. .Small rotor at back prevents craft from swinging around as a reaction to the turning of the big rotor (torque). In some craft two large counter-rotating rotors eliminate the need for the small rotor. Film: The Helicopter; (10 min.) color; available from BAVI Loan Collection.

Business Topic: Working in a Service Industry

Science Topic: Science at Work in the Auto Service Station

Unit 19 - Petroleum and Liquid Fuels

Time: 4 to 5 lessons

Aims:
- To learn how gasoline is produced.
- To learn why the characteristics of gasoline make it a desirable fuel for motor vehicles.
- To study some other fuels and their characteristics.

Development:

Concepts and Understandings	Procedures and Activities
1. Motor vehicles depend on the distillates of petroleum for fuel and lubricants.	
.Fractional distillation of petroleum yields many useful products.	Demonstrate: Distillation of petroleum, using electric heater. (CAUTION!). See Chemistry and Petroleum, p. 12 (Amer. Petroleum Inst., 1271 Ave. of the Americas, N.Y. 10020). Display: Various petroleum fractions - .gasoline .grease .kerosene .vaseline .fuel oils .paraffin wax .lubricating oils .road oil .asphalt Elicit: Uses of the various fractions of petroleum distillation. Films: (available from BAVI Loan Collection) .Petroleum (30 min.) (Chemistry Course Series) .Crude Oil Distillation (13 min.)
.The yield of gasoline from the distillation is increased by various methods.	Demonstrate: Use molecular models to illustrate cracking, polymerization, and hydrogenation. See Chemistry and Petroleum, pp. 13, 14. Film: Gasoline and Motor Fuels (30 min.) (Chemistry Course Series) Available from BAVI Loan Collection.

Concepts and Understandings	Procedures and Activities
2. Gasoline and Its Characteristics	
.Gasoline is a desirable motor vehicle fuel be - -abundant -volatile -easily ignited -relatively inexpensive -easily portable -productive of little solid waste	Discuss: Demonstration shown on p. 5, A Power Primer (free from General Motors, Detroit, Mich.) A safe demonstration, employing illuminating gas in place of gasoline, may be found in The General Science Handbook, Exer. 3324.
.Gasoline is contributing substantially to air pollution.	Discuss: Review Unit 16, Sec. 7 .Required anti-pollution devices on new cars .Carbon monoxide poisoning .Attempts to develop non-polluting and electric cars .What the individual can do - avoid running engine when parked, keep engine in good adjustment, etc.
.Modern high compression engines require gasoline with special properties to prevent knocking)premature ignition resulting in tapping noise in engine).	Chalkboard: Show cause of engine knock. Stress possible damage to engine. See A Power Primer, p. 21. Display: Advertisements promoting gasoline containing tetraethyl lead (ethyl), TCP, etc., to reduce knocking.
.Gasolines are rated on the basis of a standard test fuel which is given the rating of 100 octane.	Discuss: .Availability of two or more octane rated gasolines in most stations. .Meaning of octane ratings. .Need for higher octane gasolines in higher-compression engines.
."Dry Gas" (alcohol) is used dissolve any water that may be present in gasoline to prevent fuel lines from freezing.	Demonstrate: .Immiscibility of water in gasoline. .Miscibility of water in alcohol .Burn alcohol to demonstrate combustibility (CAUTION!) Elicit: .Water may get into gasoline in underground tanks, or by condensation of water vapor in auto tank. .Water expands in freezing, can block fuel line. .Freezing point of alcohol is much lower than that of water.

Concepts and Understandings	Procedures and Activities
3. Common fuels and their characteristics.	
.A fuel is a material that burns readily and is relatively inexpensive.	Display: Some common fuels. Burn some of them. .wood .charcoal .coal .coke .gasoline .kerosene .butane (in lighter) .propane (torch) .methane
	Films: Available from BAVI Loan Collection .Fuels - Their Nature and Use (10 min.) .Our Common Fuels (11 min.)
.Various factors dictate our choice of fuels. -availability -cost -convenience -ease of transportation -storage space available -amount of heat given per unit -disposal of waste products	Demonstrate: Burn wad of paper, light Bunsen burner. Elicit: Comparison of merits or drawbacks of each as a fuel, in regard to cost, heat produced, waste products, etc. Pupil Activity: Find out what fuels are used in heating the school, your home or apartment, local bakery, supermarket, factory, etc. Why are the particular fuels used?
.Fuels may be solid, liquid, or gaseous.	Pupil Activity: Make a list of all the fuels you can think of. Classify them as solid, liquid, or gaseous.
.To burn a fuel we need oxygen (air), and enough heat to reach the kindling temperature of the fuel.	Demonstrate: Oxygen is needed for burning. .Insert burning splint into jar of carbon dioxide. .Cover a lighted candle with a jar. .Burn steel wool in air and in pure oxygen. Elicit: Need for oxygen (air) in order for fuel to burn. Demonstrate: Kindling temperature must be reached for ignition. Boil water in paper tray. See The General Science Handbook, Exer. 1456. Elicit: .Meaning of kindling temperature. .Examples of substances with low and high kindling temperatures.

Business Topic: Working in a Service Industry

Science Topic: Science at Work in the Auto Service Station

Unit 20 - Safety in the Service Station

Time: 3 to 4 lessons

Aims: . To learn about some of the safety hazards that exist in the service station.
. To work out rules for working safely in the service station.

Development:

Concepts and Understandings	Procedures and Activities
Working in a service station presents many hazards to safety, if the worker is not aware and properly trained.	
1. Fire hazards -many combustibles are a necessary part of the service station stock.	Demonstrate: Combustibility of petroleum products. .Burn two or three drops (no more!) in a watch glass. (CAUTION!) .Burn a small wad of oil-soaked cotton. (CAUTION!) .(Optional) Explosive mixture. See Unit 16. Illuminating gas is used as the fuel. Elicit: Safety practices vs. fire: .Danger in smoking near pumps. .Need to turn off ignition of cars being refilled - where is the gas tank in most cars? Where is the hot exhaust pipe? .Need for grounding pumps. .Need to flush away spills on pavement or car. .Need for first aid supplies and knowledge of first aid.
-spontaneous combustion is a possible danger.	Demonstrate: Spontaneous combustion. See The General Science Handbook, Exer. 1419, 1420. Elicit: Safety practices .Certain materials undergo a chemical change, with release of heat. .Dangers in improper storage of rags soaked with combustibles.

Concepts and Understandings	Procedures and Activities
-special kinds of fire extinguishers are needed for gas and oil fires.	Demonstrate: Need for extinguishers which use no water. .Flammable petroleum products float on water. Ignite a small quantity of kerosene floating on water. .Use of carbon dioxide to extinguish fire. See The General Science Handbook, Exer. 1447. Display: Carbon dioxide and foamite extinguishers. Elicit: Safety practices .Why water-containing fire extinguishers are dangerous for oil fires. .Proper locations for extinguishers. .Proper types for oil fires. .Use of sand in buckets.
2. Contact with harmful chemicals.	Display: Samples of liquids handled in service stations, in their original containers (e.g., dry gas, antifreezes of various types, fuel oil, brake and transmission fluid, etc. Discuss: .Precautions to avoid contact with skin. .Information found on labels of containers, regarding nature of contents, precautions for use, antidotes.
3. Inhalation of harmful chemicals.	Discuss: .Liver and brain damage possible from inhalation of volatile solvents (glue-sniffing). .Relate to solvents and gasoline fumes, with need to provide adequate ventilation in all parts of the service station. .Special problem of inhalation of carbon monoxide exhaust (colorless and odorless). Physiological effects of carbon monoxide. .Nausea and dizziness as symptoms of inhalation. Elicit: Safety practices: .proper ventilation of indoor areas with windows, fans, and other exhaust devices. .containers of volatiles closed or sealed when not in use.
4. Injuries .Falls .Moving machinery .Dropped objects .Burns	Pupil or Class Activity: A visit to a Elicit: Areas of potential safety hazards .Falls - tripping over objects - care near pits -slipping on oil and grease spills

Concepts and Understandings

Procedures and Activities

.Moving machinery
- -hoists
- -working on auto engine, with fan blades and other moving parts exposed
- -cars slipping off improperly positioned jacks

.Dropped objects
- -tire irons
- -tools

.Burns and scalds
- -hot engines
- -opening overheated radiators

.Safety practices against all above hazards.

Pupil Activity: Imagine that you are the manager of a service station, responsible for training a new worker. Write a list of do's and dont's of safety for the new worker to study.

Business Topic: Working in a Service Industry

Science Topic: Science at Work in the Auto Service Station

Unit 21 - Friction and Lubrication

Time: 4 to 6 lessons

Aims:
- To learn what friction is.
- To learn how the operation of a motor vehicle is affected by harmful friction.
- To learn what can be done to lessen harmful friction in motor vehicles.
- To study some characteristics of lubricants used in motor vehicles.

Development:

Concepts and Understandings	Procedures and Activities
1. Friction is a force that opposes the movement of one object over another.	Demonstrate: Working against friction. See The General Science Handbook, Exer. 1328. Elicit: .Word "friction" and its meaning. .Where the friction occurs in this demonstration. .Why the pencil rollers lessen the friction.
2. Friction is caused by .Irregularity of surfaces .Attraction between molecules of the surfaces.	Demonstrate: Repeat demonstration of section 1, above, over a pane of glass, and over a sheet of sandpaper or other rough surface. Elicit: .Roughness or smoothness of surface makes for greater or lesser friction. Demonstrate: Some ways in which we increase friction where desired: .Adhesive tape, friction tape .Sandpaper .Rubber handles of tools .Ridged metal surfaces to step on.
3. Friction may result in heat and wear.	Pupil Activity: .Rub hands together rapidly. Note sensation of heat. .Sandpaper an irregular wooden surface. Note heat, wearing down of wood. .Use eraser to rub a hole through a piece of paper. Note particles of worn-away paper and rubber.

Concepts and Understandings	Procedures and Activities
	Demonstrate: .Strike friction matches .Worn brake lining, tire tread, shoe heel .Saw wood-note heat. Elicit: Friction results in the evolution of heat, and wearing-away of surface.
4. We use various methods to reduce friction where it is undesirable.	
.Smoothing surfaces	(Review): First demonstration of section 2 of this unit. Elicit: Effect of smoother surfaces. Demonstrate: Effect of lubricants .Pupil rubs hands together, then repeats after putting some liquid soap on hands. .Pupils rub finger over plain pane of glass, then over one which has had a few drops of oil placed on it. .Pupil rubs two sheets of sandpaper together. Some grease is sandwiched between the sheets, and action is repeated. .Devices that need oiling. See The General Science Handbook, Exer. 1334.
.Use of bearings	(Review): Effect of rollers in demonstration of Section 1 of this unit. See also General Science Handbook, Exer. 1329, 1337. Display: .Ball-bearing and learner's skates. Show difference in ease and duration of spin. .Old ball and roller bearings. Elicit: Action of ball and roller bearings in lessening friction.
5. Motor vehicles have many moving parts. They must be properly lubricated (oiled or greased).	Teacher Reference: Automotive Mechanics, by William Crouse (McGraw-Hill). Display: .As many auto parts as possible for which lubrication is necessary, e.g., piston, valves, crankshaft, etc. Alternatively, a class visit to the auto shop might be arranged. .Automobile lubrication chart. .Some oils and greases used in lubrication. Elicit: Reason for smoother movement of lubricated surfaces.

Concepts and Understandings	Procedures and Activities
6. The engine of an automobile is especially in need of careful and frequent lubrication.	
.Engine oil accumulates water, sludge, and other impurities.	Display: .Used and fresh crankcase oil. .Grit on a discarded oil filter. .Service manual for engine. Elicit: .A rough count of engine parts whose surfaces move over others. .At 3000 r.p.m. some surfaces move back and forth 50 times per second. .Need for proper periodic lubrication of crankcase. (oil changes) .Need for oil filter.
.Temperature changes cause changes in viscosity of oil.	Demonstrate: Comparison of viscosity of warm and cold oil. Use electric heater to heat lubricating oil. (CAUTION!) Pour warm oil into one glass cylinder, cold oil of same type into another. Drop steel ball into each cylinder. Elicit: .Which ball falls faster? .Which oil offers more resistance (greater viscosity)? .Which oil will flow more readily into the thin spaces between, for example, the piston and cylinder? .Why it is bad practice to start engine on cold day and drive off immediately. Demonstrate: Comparison of viscosity of oils with various SAE ratings. Repeat demonstration with steel balls, with 3 cylinders holding oils of SAE rating of 10, 20, and 30. Elicit: .Which fall falls fastest? Slowest? .Which oil lubricates best when outdoor temperature is low? high?
.Detergent type oils help to keep engine parts clean by holding contaminants in suspension.	Demonstrate: Emulsion formation. Add 15 drops of liquid soap to 2 inches of water and $\frac{1}{2}$ inch of oil in a large test tube. Stopper and shake well.

Concepts and Understandings	Procedures and Activities
7. Greases are lubricants of high molecular weight. They are used where friction and heat would cause breakdown in oils.	Display: .Grease and grease gun .Greased bearing, e.g., front wheel .Lubrication chart, showing grease points Class Activity: Visit to a service station to observe lubrication procedure.

Business Topic: Working in a Service Industry

Science Topic: Science at Work in the Auto Service Station

Unit 22 - Useful Friction

Time: 2 to 3 lessons

Aims: . To study some of the ways in which friction is of use to us.
. To learn how automobile brakes are designed, and how they work.

Development:

Concepts and Understandings	Procedures and Activities
1. Friction can be of use to us.	
.In many everyday activities.	Demonstrate: .Light a match .Walk .Hold a pencil Elicit: .Involvement of friction in each of above activities. .Involvement of friction in -writing on chalkboard -turning a doorknob -holding a bat -throwing a ball -sanding icy walks
.In operating an automobile.	Demonstrate: Operation of power transmission pulley (e.g., on an aquarium pump). Observe effect of belt that is too loose or too tight. Display: .Fan belt .Pictures of various tire treads .Clutch plate Pupil Activity: Measurement of tire area in contact with the ground. See The General Science Handbook, Exer. 3311. Elicit: Role of friction in pulleys, clutch, tires.
2. Auto brakes are based on the use of friction.	Reference: Jensen, L. Related Science in Automotive Trades. Albany, New York: Delmar Publications.

Concepts and Understandings	Procedures and Activities
	Demonstrate: Brake drum and shoe. See The General Science Handbook, Exer. 1331.
	Pupil Activity: Principle of the brake. See The General Science Handbook, Exer. 1332.
	Demonstrate: Principle of the disc brake. See Crouse, William. Automotive Mechanics, p. 677, (McGraw-Hill).
	Discuss: .Analogy of use of rubber-soled sneakers in sports. .Role of friction in brakes. .Composition and characteristics of brake linings. .Standard and disc brakes.
3. Brakes are operated through a hydraulic mechanism.	
.These hydraulic mechanisms are based on Pascal's Law: Any pressure applied to an enclosed fluid is transmitted equally in every direction without loss.	Demonstrate: Pascal's Law. .Tap one end of a water-filled pipe that is stoppered at both ends. How do we know the pressure was transmitted? .Piston and flask. See Olivo & Wayne, Fundamentals of Applied Physics, p. 142, (Delmar Publications, Albany, N.Y.). .Principle of the hydraulic brake system. The General Science Handbook, Exer. 3356.
.We use devices designed to employ enclosed liquids as a means of multiplying an applied force (mechanical advantage).	Demonstrate and display charts: .Hydraulic press .Hydraulic jack Discuss, using charts: .Car lift .Barber chair Elicit: .In the above devices, force is applied to a piston of small area. .The force is transmitted by a fluid to a piston of large area. .The small piston moves a large distance, moving the large piston a small distance. .Force is multiplied.
.Hydraulic brakes multiply the force exerted on the brake pedal.	Display and discuss: Chart of hydraulic brake system, in which small force applied by foot is multiplied to a large force operating on the brake shoes.

Concepts and Understandings	Procedures and Activities
	Display: .Application of pressure to all four brakes .Characteristics of brake fluid - -non-corrosive - Why? -low freezing point - why? -does not evaporate readily - why?

Business Topic: Working in a Service Industry

Science Topic: Science at Work in the Auto Service Station

Unit 23 - Tires

Time: 2 to 3 lessons

Aims: . To learn how tires are designed.
. To learn why particular materials are used in making tires.
. To learn some aspects of proper tire care.

Development:

Concepts and Understandings	Procedures and Activities
1. Today pneumatic tires are used almost universally on motor vehicles.	Display: Pictures of old motor vehicles equipped with solid rubber tires. Demonstrate: Drop a solid tire and wheel (from a shopping cart or lawn mower), and a pneumatic tire and wheel (bicycle) to show difference in "bounce". Elicit: .More comfortable ride with pneumatic tires. .Less wear on motor vehicle.
2. Rubber has many characteristics that make it desirable for use in tires. .non-porosity .elasticity .wear-resistance .good friction rating .repairability .strength .low cost	Demonstrate: .Elasticity. Inflate balloon, stretch rubber bands. .Repairability. Get a pupil to demonstrate how a bicycle tire is repaired. .Friction. Have pupils pull weighted shoe with rubber sole, and another with leather sole, across table. Display: .Pictures showing tapping of rubber trees. .(In season) - break leaf of milkweed plant to show secretion of "rubber". Film: Rubber in Today's World. (11 min.) Available from BAVI Loan Collection.
3. Many improvements have been made in tire design and materials. .Synthetic rubber is used in place of natural rubber.	Demonstrate: Production of synthetic rubber. .100 ml. synthetic rubber latex, +400 ml. water, +6N hydrochloric acid added gradually. Squeeze coagulated rubber into ball and wash.

Concepts and Understandings	Procedures and Activities
-no dependence on foreign sources. -longer wearing. -more resistant to deterioration. -some types of synthetic rubber: Buna S Buna N Neoprene Thiokel	.(Alternate method) - Dissolve 10 g. flowers of sulfur, in 4 g. of sodium hydroxide, +100 ml. of boiling water. Decant dissolved sulfur. Add 20 ml. ethylene dichloride, with stirring, at 80°C. Discuss: (optional) - Steps in production of synthetic rubber. See Materials and Processes by Kohn and Starfield (Macmillan, 1952), p. 448.
.New types of ply cords increase strength and wearability of tires.	Demonstrate: Cords in cross-sections of tires (prepared in Shop Dep't).
.Reduced wear on tires by radial positioning of cords (radial tires).	Display: Pictures and advertisements of polyglass tires. Discuss: Cords of rayon, nylon, polyglass.
.Tires are designed for maximum traction (friction), quick stopping, and quiet ride.	Display: Pictures of treads, to include snow tires and studded tires. Discuss: Friction and tires .Wearing away of tires; fast starts, excessive costs. .Safety problems - reduced friction on ice.
4. Proper tire care is important for economy and safety.	Demonstrate: An inflated mounted tire. Pupils use pressure gauge to take readings. Elicit: Proper pressures result in longer tire life. Demonstration: (optional) by auto shop teacher. Explanation of tire repair and mounting.
5. Sizes of tires are measured in a special way. The first figure, (e.g., 6.50), is the cross-sectional distance across the widest part of the tire. The second figure, (e.g., 13) is the diameter of the auto wheel without the tire.	Display: Tire advertisements, giving dimensions of tires. Relate tire sizes to costs of tires. Pupil Activity: Measure dimensions of old tires, or tires borrowed from auto shop.

Business Topic: Working in a Service Industry

Science Topic: Science at Work in the Auto Service Station

Unit 24 - Batteries

Time: 2 to 3 lessons

Aims: . To learn how electricity may be produced by chemical action.
. To study the design, operation, and proper care of the automobile storage battery.

Development:

Concepts and Understandings	Procedures and Activities
	Films: .Battery Electricity (12 min.) Available from BAVI Loan Collection. .The Story of the Modern Storage Battery (free) Ideal Pictures of Ohio, 2110 Payne Ave., Cleveland, Ohio

NOTE TO THE TEACHER: Sections 1 to 5, following, are identical with the material to be found in Science Level I Correlated with Industrial Careers I. The sections are printed here for the convenience of the teacher. The material should be reviewed briefly, if the class has already taken Industrial Careers Science. If not, the work should be presented fully, and reviewed in Industrial Careers Science.

1. An electric current can be made to flow through a wire connecting two different metals (electrodes) dipped in a conducting solution (the electrolyte).	Demonstrate: The lemon cell. Insert a penny and a dime part way into a sectioned lemon half. Coins should face, less than $\frac{1}{2}$ inch apart. Attach millivoltmeter to electrodes. Class observes deflection of meter. Repeat after carefully rinsing coins, using distilled water in a beaker. Discuss: .Pure water is not a conductor. .The acid in the lemon is a conductor (electrolyte).
2. The use of two different kinds of metal provides a more active and a less active metal.	Demonstrate: Into a test tube half-filled with dilute sulfuric acid, drop a 1" x $\frac{1}{2}$" strip of copper. Note rate of activity. Repeat with similar strips of zinc and magnesium. Elicit: .Bubbles are an indication of activity. .Ranking of the three metals in activity. .Meaning of activity in metals.

Concepts and Understandings	Procedures and Activities
3. The more active metal loses electrons. The electrons travel through the wires of the circuit. Their movement is the electric current.	Demonstrate: A voltaic cell, using a battery jar, strips of zinc and copper, dilute sulfuric acid, and a voltmeter. Elicit: .Zinc is more active than copper. .Sulfuric acid is a conductor (electrolyte). .The circuit is complete: zinc, wire, meter, wire, copper, electrolyte, zinc.
4. The current flows from the source of electrons (the more active metal) (cathode) toward the less active metal (anode).	Demonstrate: Direction of current flow by reversal of leads, causing reversal of meter pointer deflection. Chalkboard diagram and discuss: .Direction of flow of the current. .Meaning of anode, cathode.
5. Voltage may be increased by adding more cells (series). This is a battery.	Demonstrate: Hook up two lemon cells in series, or two zinc-copper cells. Elicit: .Voltage is doubled
6. Copper-zinc cells have several disadvantages. They .cannot be charged .polarize readily .are unwieldy	Demonstrate: Disadvantages of the copper-zinc cell. .Bubbles of gas form in working cell; relate to drop in voltage. .Note erosion of zinc.
7. Lead storage batteries are used in automobiles because they .can provide a large current for a short period (for starting engine). .are rechargeable by the generator or alternator of the car.	Reference: Free wall charts and manual on storage batteries. ESB Brands, 2000 E. Ohio Bldg., P.O. Box 6949, Cleveland, Ohio 44101. Display: .Cutaway auto storage battery .Chart of battery parts Discuss: Advantages of the lead storage battery. .rechargeable .reasonably compact and durable .capable of providing heavy current for a short time .(optional) Chemistry of charging and discharging phases

Concepts and Understandings	Procedures and Activities
8. Proper care and handling is needed to prolong battery life and assure safety.	Demonstrate: .Corrosive action of dilute sulfuric acid on zinc. Corrosive action of concentrated sulfuric acid on a wooden splint. Relate to effect of spilled electrolyte on hands, clothes, and auto parts. .Use of hydrometer to test charge. .Proper use of battery charger. .Voltage tester. Elicit: Rules for safety and proper care of batteries. .Keep level of electrolyte at correct height. .Avoid dropping. .Maintain correct charge. .Avoid spilling electrolyte on hands, clothing, or car parts. .Observe polarity when connecting battery.

Business Topic: Working in a Service Industry

Science Topic: Science in Cleaning and Laundering

Unit 25 - Solvents and Detergents

Time: 3 to 4 lessons

Aim: . To learn how solvents and detergents function in laundering and cleaning.

Development:

Concepts and Understandings	Procedures and Activities
In laundering and dry cleaning substances are used that act to dissolve dirt, grease, and various stains from clothing.	Note to the teacher: The activities of Sections 1 through 5 are well-suited for a full-period laboratory lesson. A second full period may be used for the stain removal laboratory, Section 6.
1. Water will dissolve a greater number of substances than will any other liquid. It is known as the "universal solvent".	Film: Washing Soda, Soap, and Synthetic Detergents. (30 min.) (Chemistry Course Series) available from BAVI Loan Collection. Demonstrate: Substances that will dissolve in water. Dissolve salt, sugar, copper sulfate, alcohol, and tincture of green soap. Elicit: .Meaning of soluble and insoluble. .Water dissolves many substances, and is therefore valuable in removing them from clothing.
2. Soaps and detergents function by emulsification.	Pupil Activity: Emulsifying action of soap. See The General Science Handbook, Exer. 2436, 2437. Elicit: .Action (emulsification) of soap on oil droplets. .Value of emulsification in washing.
3. Soaps cannot emulsify well in hard water. Detergents overcome this problem.	Pupil Activity: Detergents and hard water .Add ten drops of soap solution to two inches of calcium chloride solution (hard water), in test tube. Shake. .Repeat, using distilled water. .Repeat, using a commercial detergent in place of the soap.

Concepts and Understandings	Procedures and Activities
	Elicit: .Effect of hard water on soap. .Effect of detergents in hard water. Demonstrate or Pupil Activity (optional): Softening hard water. See The General Science Handbook, Exer. 2439.
4. To hasten stain removal, enzymes are often used with, or included in, detergents.	Demonstrate or Pupil Activity: Place two inches of a dilute starch suspension in two test tubes. Add saliva or diastase to one test tube. Note clearing action. Elicit: .Nature of enzymes .Effect on starch .Possible value of enzymes in a detergent, in breaking up stains. .Experience of pupils and families in use of enzyme-containing detergents.
5. Bleaching is used in both laundering and cleaning.	Demonstrate or Pupil Activity: Bleaching action. See The General Science Handbook, Exer. 3414, 3450.
6. Water cannot always be used as a solvent. In such cases, dry cleaning is necessary. .Some substances are insoluble, or only slightly soluble, in water.	Demonstrate: Attempt to dissolve in water: camphor, olive oil, benzene, chlorophyll, gum. Elicit: (review) - meaning of soluble, insoluble.
.Some fabrics are ruined by water.	Demonstrate: Soak a piece of silk or satin cloth in hot water. Allow to dry. Elicit: Unsuitability of water for cleaning some fabrics.
.No water is used in the dry cleaning process. Solvents such as naphtha (flammable), and carbon tetrachloride (non-flammable) are among those most commonly used.	Demonstrate: How safe are cleaning solvents? See The General Science Handbook, Exer. 3451. References: .U.S. Gov't Printing Office - Booklets on cleaning and washing. .N.Y.C. Board of Education, Home Economics Syllabus, Grades 7,8,9.

Concepts and Understandings

Procedures and Activities

Laboratory Lesson: Stain removal.
Prepare a mimeographed sheet with directions for stain removal, along the line of the directions which follow:

HOW TO REMOVE SOME COMMON STAINS FROM CLOTHING

STAIN	PROCEDURE
Blood	Sponge stain or soak in cold water. Then wash fabric in warm soapy water.
Grease	Rub with detergent, then wash in hot water. If not completely out, rub the stain with cleaning fluid.
Ice Cream	Sponge with cold water. Then wash in warm soapy water.
Grass	Sponge stain with alcohol, then wash.
Soft drinks	Sponge stain with cool water. If cloth is white, dip into a chlorine bleaching solution for one minute. Rinse. If cloth is colored, pour glycerin on it. Let stand for half-hour, then rinse.
Fruit	Sponge with cold water at once, then wash. If white, use a bleach. Do not iron, or stain will set.
Chewing gum	Soften the stain with white of an egg, then wash in lukewarm soapy water. Gum may also be hardened with an ice cube, then rubbed until it crumbles.
Chocolate	Scrape off as much of the chocolate as possible. Then wash in warm soapy water.

Business Topic: Working in a Service Industry

Science Topic: Science and Restaurant Operations

Unit 26 - Pest Control

Time: 1 to 2 lessons

Aims: . To understand the dangers that insect and rodent pests present to man.
. To study some of the ways used to control pests.
. To appreciate the safety precautions in the use of pest controls.

Development:

Concepts and Understandings	Procedures and Activities
1. Insect and rodent pests are undesirable because	
.they are vectors of many human diseases.	Demonstrate: Allow a housefly or a roach to walk across surface of sterile agar in Petri dish. On another dish, repeat with a laboratory mouse. Incubate. Show colonies of bacteria. Discuss: Insect and rodent borne diseases. See Buchsbaum, R., Animals without Backbones (University of Chicago Press), and Zinnser, Rats, Lice, and History.
.many millions of dollars' worth of food are lost each year to insect and rodent infestation.	Display: .Meal worms (obtainable at pet shops) .Mites on lettuce. Reference: Yearbook of Agriculture, 1952 - Insects (U.S. Government Printing Office)
2. Control of insects and rodents requires several steps.	
.proper packaging and storage can deprive pests of their source of food.	Display: .food tins .glass containers .waxed cartons .cellophane film wrapping .sealable bins Discuss: .Role of proper packaging and storage in pest control. .Role of cleanliness in pest control.

Concepts and Understandings	Procedures and Activities
.use of qualified exterminators	Discuss: .Some modern insecticides (See Burpee Seed Catalogue, Burpee Co., Phila., Pa. 19132.) .Dangers in misuse of insecticides. (See Roueche, Berton, Twelve Blue Men and Other Stories.) .Types of rodenticides and their dangers.
.evidence of pest's presence, and sure identification of the pest.	Display: Chart of grasshopper Discuss: Major parts of an insect. Display and discuss: .insect pest evidences - roach egg cases, body parts. .rodent evidence - droppings, hair, nibbled paper; mention odor. References for Pupils: .DeWaard, What Insect Is That? (American Education Publications Center, Columbus, Ohio 43216. 25¢.) References for Teachers: .Ross, H.H. How to Collect and Preserve Insects (free) (Illinois State Natural History Survey, Urbana, Ill.) .Yearbook of Agriculture, 1952-Insects. (Department of Agriculture) U.S. Government Printing Office. .Yearbook of Agriculture, 1966-Protecting Our Foods. .Yearbook of Agriculture, 1959-Food.

Non-Correlated Units

Two units not correlated with the work of Business Careers are listed here. The purpose of these units, along with similar non-correlated units in the Health-and-Industry-related science curricula, is to provide the pupil with a science background comparable to that offered the general student in the regular high school science courses.

1. A Unit in Evolution

   See General Biology Curriculum, Unit IX, "How Have Living Things Changed?" (Board of Education, Bureau of Curriculum Development, Curriculum Report #454 - 12/16/66.)

2. A Unit in Earth Science (Astronomy, The Solar System, Energy in the Solar System, Man and Space). See Science Grade 9, Unit III. (Board of Education, Bureau of Curriculum Development, Curriculum Bulletin No. 9, 1968-69 Series.)